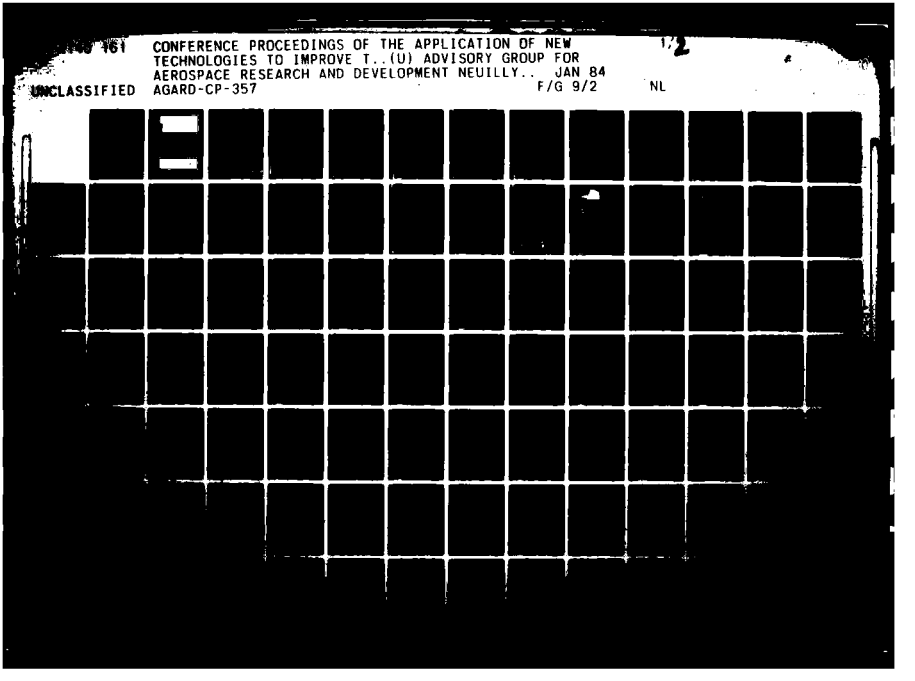
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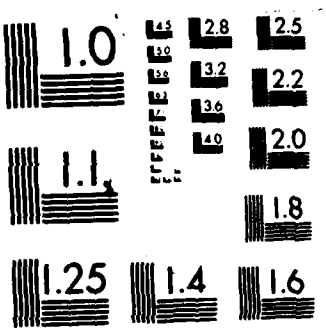

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AGARD CONFERENCE PROCEEDINGS No. 357

The Application of New Technologies to Improve the Delivery of Aerospace and Defence Information

NORTH ATLANTIC TREATY ORGANIZATION

DISTRIBUTION AND AVAILABILITY ON BACK COVER

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(TITLE): Conference Proceedings of The Application of New Technologies to Improve the Delivery of Aerospace and Defence Information Held at Ottawa, Canada on 14-15 September 1983.

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AD-P003 092	The iNet Gateway Trial.
AD-P003 093	Sharing Command Languages and Software.
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AGARD Conference Proceedings No.357

THE APPLICATION OF NEW TECHNOLOGIES TO IMPROVE THE DELIVERY OF AEROSPACE AND DEFENCE INFORMATION

Copies of papers presented at the Technical Information Panel Specialists' Meeting held in Ottawa, Canada, on 14–15 September, 1983.

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The mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace for the following purposes:

- Exchanging of scientific and technical information;
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture;
- Improving the co-operation among member nations in aerospace research and development;
- Providing scientific and technical advice and assistance to the North Atlantic Military Committee in the field of aerospace research and development;
- Rendering scientific and technical assistance, as requested, to other NATO bodies and to member nations in connection with research and development problems in the aerospace field;
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THEME

The pace of development of new technologies in communication networks and information delivery systems has been extremely rapid over recent years and it was the purpose of this Symposium to review these developments and the ways in which they are being, and can be, applied to increase the effectiveness of managers, engineers and scientists.

Attention was directed particularly to the interconnecting of data bases and information centres within communication systems that will permit the retrieval and post-processing by end-users. Other papers dealt with ways and means by which intelligent terminals, micro and mini computers can be used in the actual aggregation and post-processing of data information. Examples of how the new technologies can increase the productivity of scientists and engineers to improve the decision-making capabilities of programme managers were provided.

Le rythme auquel se sont développées, ces dernières années les nouvelles technologies dans le domaine des réseaux de communication et des systèmes de dissémination de l'information a été extrêmement rapide. Le Symposium organisé se proposait de passer en revue ces divers développements et les méthodes suivant lesquelles ils sont, et peuvent être appliqués pour améliorer le rendement des administrateurs, ingénieurs et scientifiques.

L'accent a été mis tout particulièrement sur l'interconnexion des bases de données et des centres d'information à l'intérieur des systèmes de communication, qui permettra l'extraction des données et leur post-traitement par les utilisateurs ultimes. D'autres exposés décriront les procédures selon lesquelles les terminaux intelligents et les micro et mini-ordinateurs peuvent être exploités pour véritablement amalgamer et post-traiter les données et les informations. Des exemples ont été données quant aux modes d'utilisation des nouvelles technologies permettant d'accroître la productivité chez les scientifiques et les ingénieurs et d'améliorer l'aptitude à la prise de décision chez les responsables de la gestion des programmes.

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The Technical Information Panel wishes to express its thanks to the Canadian National Delegates to AGARD for the invitation to hold this symposium in Ottawa, Canada, and for the personnel and facilities made available for this meeting.

CONTENTS

OPEN SYSTEMS INTERCONNECTION FOR THE DEFENCE COMMUNITY

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SUMMARY

The area of Open Systems Interconnection is a very active area. This paper attempts to give some idea of what is going on but does not claim to be complete or current. Many proposals now under discussion will be changed or dropped. However, the concept of a layered approach to communication standards is generally accepted and the OSI Reference Model appears to be successful as a working approach toward integration of the many standards involved in open connection. The Reference Model is not in itself a communication standard but rather a framework for standards development. As such, it will permit evolution of standards as needed in a changing technology, while providing a coherent approach to the many problems involved in Open Systems Interconnection.

1. INTRODUCTION

Open Systems Interconnection (OSI) is a conceptual architecture for information exchange consisting of seven layers of protocol following existing and proposed ANSI and ISO standards. The division into layers is intended to facilitate standardization activities. Each layer interacts only with its adjacent layers. The International Standards Organization (ISO) has prepared a Basic Reference Model for OSI.[1] The OSI layers are summarized in Table 1.

Layer Number	Layer Name	Purpose
1	Physical Layer	Transmission of data bits.
2	Data Link Layer	Transfer of blocks of data reliably.
3	Network Layer	Routing and switching of blocks of data.
4	Transport Layer	Provide full-duplex transparent pipe for data exchange.
5	Session Layer	Establish and manage communication dialog.
6	Presentation Layer	Resolve differences in data structure.
7	Application Layer	Perform information exchange for application process.

Table 1. ISO Model for Open Systems Interconnection

Most network protocols have used some form of "layering". The advantages of a layered approach are summarized by W. E. Davison:[2]

- The ability to "divide and conquer" a complex technical problem.
- Reduction of complexity by imposing a discipline on the interactions between system components by defining and limiting those interactions.
- Definition of a standard nomenclature for discussion and design of network systems.
- Definition of a standard architecture that facilitates and encourages the development of standard procedures for all levels.
- The ability to replace any single building block with a better one without disturbing any of the others.
- Simplified error detection and program debugging.

R. deaJardins[3] describes a concept of "Universal Federal OSI Connectivity" as a goal of the existing standardization activities:

- As a result of universal connectivity, a Federal remote terminal operator would need to be concerned only with the identity of the process to which he had to connect; his own terminal's authorized identity, function and priority; and whether the network was able to accommodate his request.

The use of OSI in a military environment is discussed by Davis and Bates,[4] with emphasis on system survivability and dynamic rerouting. Practical experience with the ARPA network is also discussed.

* Operated by Union Carbide Corporation under contract W-7405-eng-26 with the U. S. Department of Energy.

2. OSI STANDARDIZATION

Within each layer, international and national standards organizations are active in various stages of preparing, testing, and proposing standards. The Reference Model of OSI is used to provide protocols for standardization and to relate the standards to each other. Thus, progress is being made in all layers independently; yet, all standardization activities are coherently working toward a common goal of open communication. The overall architecture is being developed by the Open Systems Interconnection Subcommittee of the International Standards Organization, ISO TC97/SC16, R. desJardins, Chairman. Regional standards organizations, e.g., CCITT, NBS, ECMA, ANSI, coordinate their activities through ISO.

The sequence of ISO standardization typically begins in a Working Group (WG) of a Subcommittee (SC) of an ISO Technical Committee (TC). The WG prepares a Draft Proposal (DP), which is submitted to national representatives for discussion, testing, and voting. If approved, the Draft Proposal is issued as a Draft International Standard (DIS). After more extensive testing, revision (usually), and voting, a DIS may become an ISO Standard. The Basic Reference Model of OSI is now a Draft International Standard, DIS 7498.

Tables 2, 3, and 4 show some of the many standardization activities in different layers. This list is intended to be illustrative, not comprehensive or up-to-date. It is expected that Draft Proposals in most of these areas will be approved in 1983 or 1984, and that "by the end of the 1980's all segments of the Federal government will be using teleprocessing to conduct their day-to-day operations in a universal OSI connectivity mode."[3]

NAME AND SOURCE	DESCRIPTION AND STATUS
CCITT Recommendation X.25 • Interface between data terminal equipment and data circuit-terminating equipment for terminals operating in the packet mode on public data networks.	The X-25 Packet Level covers packet formats, virtual calls, data flow, call management. Proposed by CCITT in 1976; updated version approved in 1980. The X-25 Link Level covers link management and error recovery.
Other CCITT "X-Series" Recommendations	X.3, X.28, X.29 concern "start/stop" terminals. X.75 connects multiple X.25 networks. X.121 is an international numbering scheme.
IEEE Project 802 • Local area networks.	Established in 1980; draft IEEE standard expected 1983. IEEE 802 standards are split into the following three areas: (1) 802-3 is a carrier-sense multiple access with collision detection network (link ethernet); (2) 803-4 is a token-passing bus network; 803-5 is a token-passing ring network (favored by IBM).
ISO TC97/SC13; ANSI/X3T9 • Local distributed data interface.	Standard for host-to-host cable bus; draft ANSI standard expected 1983.
NBS; ANSI/X3S3 • Federal internet protocol.	Connects agency, public, and private networks.
CCITT Working Group • Integrated Services Digital Networks	Includes voice, message, and data. Preliminary standards in 1984.

Table 2. Standardization Activities in Layers 1, 2, and 3

NAME AND SOURCE	DESCRIPTION AND STATUS
British Post Office User Forum A network independent transport service.	Flexible addressing structure. Issued February 1980.
U.S. Department of Defense Transmission Control Protocol	Adopted
ISO TC97/SC16 DP8072,8073 Transport Service Definition Transport Protocol Specification	Draft proposal approved June 1982; currently in balloting for a Draft International Standard.
ISO TC97/SC16 DP8326,8327 Session Protocol	Draft proposal 1983.

Table 3. Standardization Activities in Layers 4 and 5

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Table 3. Standardization Activities in Layers 4 and 5

NAME AND SOURCE	DESCRIPTION AND STATUS
ISO/TC97/SC16/WG5 The Presentation Service	Abstract data types. See reference 5.
ISO/TC97/SC16/WG5 DP8211 - Specification for a Data Descriptive File for Information Interchange.	Includes methods for transmitting a variety of data types and structures.
NBS File Transfer Protocol	COPY, APPEND, APPEND_EXISTING, DELETE, RENAME, LIST, KILL, RESTART, SUSPEND, STATUS, INTERRUPT
Federal Information Processing Standards (FIPS)	Program in cooperation with NBS.
Federal Telecommunications Standards Program	Project of National Communications System.

Table 4. Standardization Activities in Layers 6 and 7

3. AN EXAMPLE

The Washington Library Network, the Research Libraries Group, Inc., and the Library of Congress began in 1980 to plan an OSI-compatible network linking the three systems. This became known as the Linked Systems Project (LSP) and is described in Reference 2. The first goal is to share an authority file, the Name Authority File Service (NAFS) as a step in reducing system incompatibilities. Later, retrieval services and bibliographic data will be shared. The LSP is being designed to be extensible to more systems beyond the initial three.

The linkage will be via Telenet using X.25 protocol. The Transport Layer and Session Layer will follow the ISO draft proposals. Specifications for the Presentation and Application Layers were prepared by James Aagaard of Northwestern University Libraries, in cooperation with the Bibliographic Interest Group in Canada. Bibliographic records will be transferred in the MARC format. The use of a Data Descriptive File with file interchange is not planned.

The user will communicate with the local system via a terminal. The local computer communicates with the target computer. At most, two systems will be involved in a given session. Any user can search any authority file using the local search language which is translated into the language of the target system. Distributed file maintenance will also be possible. Contributed records are placed in a queue in the sending system and transmitted one at a time. Each record is checked for integrity. Operation in 1983 is planned.

4. BIBLIOGRAPHIC STANDARDS

For most of us, it is hard to remember that there were once more than 20 ways of representing characters on punch cards and more than 60 internal representations in computers.[6] One of the early (1958-59) code standardization projects occurred in the U.S. Department of Defense and resulted in the Fieldata Code on Military Standard 188, which was later used as internal code in Univacr 1107, 1108, and 1110. Some features of Fieldata are seen in the ISO code.

There were also code standardization projects at the British Standards Institution (BSI), SHARE (for IBM equipment), American Standards Association (ASA, now ANSI), Business Equipment Managers Association, Electronic Industries Association, Consultative Committee International for Telegraph and Telephone (CCITT), European Computer Manufacturers Association (ECMA), and the Electrical Engineering Association of the UK. No code would please everyone.

This was the situation at the first meeting of ISO/TC97 Working Group B in 1962. Out of this confusion eventually came a standard code, ISO 646, Data Processing -- 7-bit Coded Character Set for Information Interchange.

As more characters and alphabets became needed, methods for "extending" the code were developed and eventually standardized as ISO 2022, Information Processing -- ISO 7-bit and 8-bit Coded Character Sets - Code Extension Techniques. An ISO international register of escape sequences was established based on ISO 2375, Data Processing Procedure for the Registration of Escape Sequences. Many escape sequences have been registered; but, as far as this writer is aware, not many exchange projects are actually using escape sequences.

Two alphabets can be processed without escape sequences and, for most projects, two alphabets are sufficient. For example, ISO-646 and GOST 13052-74 (USSR National Standard Cyrillic Set) can both fit on an ISO-2022 8-bit chart if the exchanging parties agree on ISO-646 as the G0 set and GOST 13052-74 as the G1 set.

One goal of standardization projects is to reduce the need for special agreements on message formats between exchanging parties. For example, in an exchange following ISO/DP8211, the above-mentioned agreement is not necessary. In a specified location in the DDR (Data Descriptive Record), the sender can indicate that GOST 13052-74 or any other registered set is to occupy the G1 position.

The use of ISO 646 in an 8-bit environment has been formalized as ISO 4873, Information Processing -- 8-bit Coded Character Set for Information.

Present standards for character exchange refer to the character itself and not to its appearance on a printed page or display device. Various suggestions have been made for exchanging character printing fonts (e.g., boldface, italic, superscript, subscript), diacritical symbols, or superposition of characters (see, for example, reference 7).

The major standard for bibliographic record formats is ISO 2709, Documentation -- Format for Bibliographic Information Exchange on Magnetic Tape. It was issued in 1973 and most international bibliographic exchange projects now use the ISO 2709 format or something close to it.

An ISO 2709 record consists of a record label (currently called a leader), a directory, and contiguous data fields. There are four types of data fields, according to the use or non-use of internal indicators and identifiers. Except for the leader, all fields are variable in length. This format is well suited to library-type files, where many variable-length fields are possible but usually each record contains only a few fields. If a possible field is not present in a given record, it is simply not mentioned in the directory; there is no "overhead" for missing fields.

Although designed for one-dimensional text data, ISO 2709 records can also be used for numbers, vector, arrays, sequential structures, relational structures, hierarchical structures, network structures, and indexes as shown in ISO/DP8211.

A small but perhaps interesting point concerns the interaction of ISO 2022 and ISO 2709. An escape sequence in ISO 2022 is intended to last until another escape sequence or data link escape occurs. Thus, if the receiving party wishes to make some selection from the incoming data, a full scan is still necessary and a situation could occur in which it is necessary to insert escape sequences with corresponding recalculation of directories. It is generally assumed that for any extensive processing, the records will be converted to some internal format. Therefore, processing efficiency in the exchange format is not considered a major factor. However, for purposes of selection and sorting, and for ease of conversion to internal formats, it may be desirable to start each record or each field in the default character sets. ISO/DP8211 specifies that an escape sequence used within a data field governs subsequent characters until the next escape sequence or the end of the field, whichever comes first.

Several approaches to standardization of content designators (tags, indicators, identifiers) have been suggested. The International Federation of Library Associations (IFLA) has developed a content designator format called UNIMARC, patterned after the US MARC format in conformity with AACR (Anglo-American Cataloguing Rules). UNIMARC is widely accepted but not widely used.

The UNISIST/ICSU-AB Working Group on Bibliographic Descriptions prepared a Reference Manual for machine-readable bibliographic descriptions, designed to accommodate abstracting and indexing services. The Reference Manual is widely accepted but not widely used.

A symposium entitled "Towards a Common Bibliographic Exchange Format" was held in 1978 to bring together proponents of UNIMARC, the Reference Manual, and other formats, such as CMEA's MEKOV-2. The symposium formally agreed on the use of ISO 2709 and that the search for a common bibliographic exchange format should continue.

In addition to institutional differences, the library community and the abstracting and indexing community have an important conceptual difference. Library records traditionally refer to objects in the library (one object - one record) while abstracting and indexing records traditionally refer to authored works (one article - one record). Thus, conversion from one system to another would be difficult even if the formats were common.

The present writer was involved in preparation of a Common Communication Format for exchange of bibliographic information between the USA and USSR.[7] The adopted approach was based on UNIMARC, modified slightly to accommodate USSR standards, mainly GOST 7-1-76 Bibliographic Description of Printed Matter, and extended to include articles, reports, patents, and industrial catalogs. Bibliographic experts from GPNTB (USSR State Public Library for Science and Technology) and VINITI (All-Union Institute for Scientific and Technical Information) participated in the format design. Aside from some minor tests, this Common Communication Format has not been used.

When a new standard appears, there may be a time lag before its general acceptance. Appearance of a new standard does not automatically provide the funding and the respite from daily activities needed for the conversion to the new standard. The "wait and see" or "if we get some requests we'll open a new output stream" attitudes appear typical.

However, installations involved in data exchange typically have a sizable budget for format conversions. There is also a delay involved in writing software for format conversion. Some potential information exchange may not occur because of these costs and delays. Progress toward Open Systems Interconnection should help in these areas.

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1. ISO Draft International Standard DIS 7498, Data Processing - Open Systems Interconnection - Basic Reference Model, March 1982.

2. W. E. Davidson, The WLN/RLG/LC Linked Systems Project, Information Technology and Libraries, Volume 2, Number 1, March 1983, Page 34.

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Helpful conversations with R. desJardins (Computer Technology Associates), A. A. Brooks (Union Carbide Corporation - Nuclear Division), S. McCallum (Library of Congress), A. Trivedi (Northern Telecom Incorporated), and J. Coyne (U.S. D.O.E. Technical Information Center) are gratefully acknowledged.

The iNet Gateway Trial

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Summary

The iNet Gateway is an intelligent network concept developed by the Computer Communications Group (CCG) of the TransCanada Telephone System (TCTS). iNet has evolved in recognition of the requirement for more universal accessibility to information providers and other computer-based services. The iNet Gateway is designed to simplify the process of gathering, using and communicating information by offering a single point of access to satisfy the information needs of a user.

In order to test the concept of intelligent networking a one year field trial is being conducted from July 1982 to July 1983. 400 trialists from the banking, communications, energy, real estate, legal, travel and bibliographic sectors are participating. The Bibliographic Common Interest Group (BCIG) is undertaking a series of specific projects to evaluate the utility of gateway technology to the information transfer process.

In February 1982, the Computer Communications Group (CCG) of the TransCanada Telephone System (TCTS) officially announced the iNet Gateway trial. The TCTS is an association of 9 provincially and federally regulated telephone companies. The Computer Communications Group is an association of the data transmission service components of the telephone companies within the TCTS. The trial commenced on July 12, 1982 and will terminate in July 1983.

Purpose of the iNet Gateway Trial

The purpose of the trial is to provide the business and information communities with a single point of access to a great variety of computer systems including international, national and local networks as well as "offline" services provided by information specialists or intermediaries. The trial is expected to further define the requirements for value-added network services (I NK, 1983).

Information resources accessible through iNet correspond to the following broad categories: finance, economics, industrial, general business and industry, news, scientific and technical, legal, government, professional services, entertainment and consumer information.

Market forces

Market forces leading up to the development of intelligent networks can be summarized as follows:
- rapid growth in the electronic information industry
- proliferation of computer-based applications
- popularization of data services
- increasing trend by the general office worker to utilize and apply computer based communications services.

iNet responds to the above market forces by providing:
- a single point of access for the information user
- a means of facilitating user access to multiple services
- a means of adapting data networks to office communications and support for value-added services
- a gateway that accepts user access via a variety of terminal types and communications facilities supporting graphic, numeric and textual/bibliographic applications.

Participants

Participants in the trial fall within two distinct categories.

a) Common Interest Groups representing private or public organizations with similar information, messaging and service requirements. In the iNet trial seven such groups represent the following sectors: banking, communications, energy, real estate, legal, travel and bibliographic, with the latter being coordinated by the National Library of Canada. The Canada Institute for Scientific and Technical Information, the National Library of Canada and the libraries of the University of Guelph, Carleton University, Université du Québec and the University of Waterloo are participating trialist and information providers within the Bibliographic Common Interest Group.

b) 35 Information Providers (IP's) which sustain network content, by giving access to over 500 databases and services in iNet.

Network Components

iNet consists of three technical components:

a) Terminal/communications access to the network

b) Intelligent network

c) Information services connected to the network

Terminal/Communications Access

Users can access the iNet Gateway via DATAPAC, dedicated circuit services, private branch exchanges (PBX's) or via the public telephone network.

iNet supports a wide range of standard ASCII and alphageometric (VIDEOTEX) terminals. For example, the prototype Displayphone developed by Bell Northern Research permits access to alphanumeric and alphageometric applications through one integrated voice/data terminal. In order to allow trialists the use of all applications in iNet, 250 alphageometric terminals including 150 modified Displayphones have been made available by the TCTS to members of Common Interest Groups for the duration of the trial.

Intelligent Network

The Intelligent Network component performs the following functions:

a) A Trial Network Access Node (TNAN) computer provides authentication and security services which uniquely identify all users. It controls their authorization level for access to network connected hosts.

b) Directories

Network resources are described by and accessible through a hierarchy of electronic directories of which there are three types:

I) Public Directory

A consolidated listing of all Information Service Providers participating in the iNet trial with descriptions of services that can be accessed by a user. Each will list the name of the information provider, database description, scope, content, frequency of update, conditions of use and other important details. Databases and services are categorized under broad subject headings and a user can obtain additional information by selecting a menu number preceeding the desired service. Connection to any host can be achieved at the Public Directory level by authorized users.

II) Organizational Directory

The content and structure of this directory is defined by a user organization, is seen only by members of this organization and may, in addition, include exclusive access to company owned and maintained computer systems as well as services listed in the Public Directory.

III) Personal Directory

The content of this directory is defined by individual users, includes frequently accessed databases and services and is an efficient way of being automatically connected to a host.

c) Auto Access

A user signs on to the network only once per session. Access to authorized hosts through the gateway is automatic when a directory item is chosen. No additional identification from the user is required since the network intelligence stores the user's profile which in turn provides sign-on codes and passwords required by the target system.

d) Management and Administration

System messages, such as host downtime and system updates, are presented to the user after signing on. Additional support information provided to a user includes help functions, hours of operation as well as operating instructions. User profile updating, changes to directory information and general support are provided by system administrators. The management function includes identification and disconnection of malfunctioning terminals and hosts and notification of affected users. Statistical information for billing and traffic studies are being processed by this network component.

Information Services

Messaging

Electronic messaging is available to all iNet trial participants via the ENVOY 100 service of the TCTS. Designed to meet the needs of the Canadian public and private sector to effectively manage their increasing flow of information, ENVOY 100 provides a wide range of customer-selectable features and options. Users may prepare, correct, send, distribute, access and file messages destined within and between subscribing companies, and retain permanent records of important communications. Users of the service are independent of time zones. Messages can be put into the system, any time, from anywhere and held until the addressee is available, or optionally, messages can be delivered automatically to designated auto delivery stations. ENVOY 100 can support custom-made electronic worksheets for the transmission of structured or scripted financial, textual or bibliographic data.

Information Retrieval

Over 500 databases are accessible in the iNet trial spanning full-text, scientific/numeric, bibliographic and videotex applications. Information providers include B.C. Telephone, Bell Canada (VISTA), Canada Systems Group, Infomart, Informatech, Info Globe, I.P. Sharp Associates Ltd., New Brunswick Telephone, Official Airline Guides, QL Systems Ltd., the Financial Post, the National Library of Canada, the Canada Institute for Scientific and Technical Information, the Department of Supply and Services, BRS, SDC and Lockheed, to name only a few.

Bibliographic Common Interest Group (BCIG)

The Bibliographic Common Interest Group's overall objective in the iNet trial is to test and evaluate the application of computer/communications technology to the library environment. To this end a number of projects have been defined for the trial.

Bibliographic Interest Group Projects

1) Systems Interfaces

2) Directories supporting access to network resources

3) Derivation of bibliographic data from network connected hosts

4) Use of electronic messaging for interlibrary lending procedures and administrative communications

5) Creation and dissemination of videotex databases

6) Use of information provider databases for information retrieval (alphanumeric and videotex)

7) Prototype bibliographic file transfer

Systems Interfaces

The objective of this project is to test the connection of the following BCIG computer systems to iNet.

The DOBIS system, developed by the National Library of Canada and CISTI resides on an IBM 3032. This included the operational testing of an X.25 asynchronous terminal protocol converter to enable ASCII terminal access to the system. CAN/OLE (Canadian Online Enquiry) and CAN/SND (Canadian Scientific Numeric Databases) reside on an IBM 3033 and support DATAPAC 3101 access. CATSUP (Catalogue Support), is an online library catalogue database operated by Carleton University on a Honeywell 66. The University of Waterloo's library circulation system CAM (Community Access Module) resides on a GEAC minicomputer as does the University of Guelph's RAM (Remote Access Module) system. Finally, the Université du Québec's VAX-11/780 DEC minicomputer supports the BADADUQ (Banque de données à accès direct de l'Université du Québec) online catalogue.

The project established early on that diverse hardware and operating systems can be connected to iNet.

Directories

The creation, maintenance and utilization of bilingual electronic directories allows participants to assess the extent and type of information that is required to support the use of information applications within an open network environment. Typically a service will require the following details to be included in a directory:

a) Abbreviated name of Service Provider

b) Full name of Service Provider

c) Organization responsible for service or database

d) User specific notes respecting service or database

e) Scope and content of service or database

f) Coverage and update cycle

g) Service hours, costs

h) Contact

i) Descriptors, subject headings or keywords required to permit access to the application via the Public Directories

Derivation of Bibliographic Data

This project is designed to assess the usefulness of different databases for library catalogue support operations by enabling users to access bibliographic records maintained in unilingual or bilingual catalogue support systems. Time and cost comparisons between iNet-derived bibliographic data, versus original cataloguing or existing data derivation methods, are being carried out.

Use of Electronic Messaging for Interlibrary Lending Procedures

During the iNet trial BCIG participants will utilize the electronic messaging capabilities of ENVOY 100 to assess the potential of new telecommunications services to improve the process of transmitting and processing interlibrary loan requests. The ENVOY 100 scripting capability has been utilized to prompt a user for specific data elements corresponding to the item requested, type of material (ie. journal article, book, conference, report, etc.) and type of transaction (ie. loan, photocopy, locations). Even though this service is an important part of the iNet trial it should be pointed out that CISTI at this time receives over 2,000 requests per month or 10% of its total volume via the ENVOY 100 system. This is an early indication that transmission of interlibrary loan data via scripted, electronic messaging systems will be an established transmission mode. Since machine-readable data is being sent, electronic messaging systems, such as ENVOY 100, can be readily adapted for post-processing by library-owned computer systems for the purpose of automatic call-numbering, management information, statistical analysis of collection use and automatic routing to designated stack points.

Creation and Dissemination of Videotex Databases

The purpose of this project is to determine the feasibility of utilizing evolving videotex technology as a means for electronic publishing to enhance the service capabilities of participating institutions. As an example, the Canada Institute for Scientific and Technical Information, in cooperation with the Division of Building Research of NRC, has created an English/French videotex database on the subject of Building Research and Technology dealing with such popular topics as energy conservation, construction methods and building materials.

An interactive document ordering feature allows a user to place a request for the full text of the publication. In addition, an online opinion survey capability has been implemented to gather input on the usefulness of the database and to obtain suggestion for enhancements in both scope and general presentation. CISTI's CAN/SND program applies TELIDON technology for the display of molecular structures.

Use of Information Provider Databases for Information Retrieval

The iNet resources facilitate access to the publicly available host systems and databases of other Common Interest Groups and to those of the participating commercial information providers. At present, these systems must be accessed individually through a multi-step, target-system specific, logon procedure. Since iNet facilitates automatic connection to any host attached to the network, it will be determined whether iNet can provide simplified and faster access for a user wishing to utilize a wide variety of bibliographic and non-bibliographic databases and information services. Through testing of selected systems and predetermined search strategies both inside and outside iNet, both consumers and providers of information can determine the impact on cost and productivity by allowing a user to interact with computer systems via intelligent networks.

Prototype Bibliographic File Transfer

iNet is being tested in the Open Systems Interconnection context (Buchinski, 1980). Developments now underway at the National Library of Canada will permit, by July 1983, the prototype transfer of CAN/MARC records between DOBIS and four connected library computer systems using iNet as the transport vehicle. The same concept will be tested between the library-owned systems of the Université du Québec and Carleton University. File transfer, which need not be restricted to cataloguing data, is an important step in achieving access to and exchange of data in a nation-wide Canadian information network.

iNet Phase II

Subject to regulatory approval, the iNet Phase II Market Trial will commence in July 1983. Scheduled to last approximately one year this phase will introduce and test a rate structure based on the utilization of the value-added features and communications services provided to the user by iNet, and charges to information providers for connection to the network and its service facilities. A significant enhancement will be the introduction, as an option, of Accounts Receivable Management whereby the TCTS will provide a customer with one consolidated statement of expenditures, including those incurred with the information providers and, for a fee, manage all accounts receivable and reimburse the IP's for services rendered to iNet users.

The present user population of 400 trialists will be expanded to approximately 1600. Recruitment will include industry segments not previously represented. The addition of new information providers will continue and marketing will be targeted to specific application groups such as librarians, financial analysts, economic analysts, media and public relations, scientific researchers, general administrators, executives and last but not least the emerging home and personal computer user.

Conclusion

Although a formal assessment of the trial by the Bibliographic Common Interest Group will not be completed before November 1983, it can be stated that iNet has successfully implemented the concept of providing an information user with a single point of access to network resources residing in a great variety of host computer systems. Value-added services such as electronic mail, Public Directories, automatic authentication and logon, and many other iNet features provide a reliable path between information users and information providers.

The long-term viability and acceptance of intelligent gateway networks will greatly depend on the rapid development and implementation of improved user interface capabilities such as enhanced directories format and content, common, user-friendly command languages and computer assisted learning and help functions.

References

1) E.J. Buchinski, M. Islam
The Context of Interconnection for a Nation-wide Bibliographic Network
Canadian Network Papers No 1, November 1980
National Library of Canada

2) Impact of Gateway Services
LINK Electronic Information Program
LINK #0039, April 1983
LINK Resources Corporation, New York, New York 10003

Acknowledgement

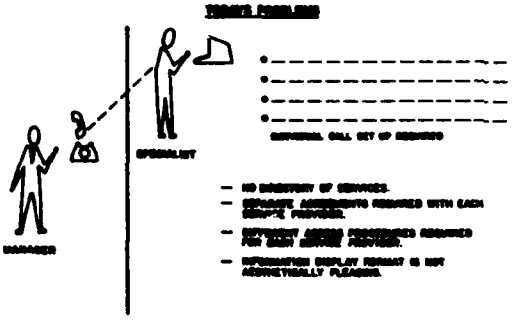
The author gratefully acknowledges the guidance and advise provided by Mr. David McCallum, Bell Canada, in the preparation of this paper.

THE INTELLIGENT NETWORK

THE MARKET FORCES

- RAPID GROWTH IN INFORMATION INDUSTRY
- MORE SOPHISTICATED APPLICATIONS
- PROLIFERATION OF DATA SERVICES
- NEW GENERATION OF USER
- NEED FOR "VOICE-LIKE" GENERALITY

TODAY'S PROBLEMS



- NO DISCOVERY OF SERVICES
- SEPARATE AGREEMENTS REQUIRED WITH EACH SERVICE PROVIDER
- SEPARATE ACCESS PROCEDURES REQUIRED FOR EACH ACCESS PROVIDER
- INFORMATION DISPLAY FORMAT IS NOT ACCEPTABLY PLEASING

THE SERVICE CONCEPT

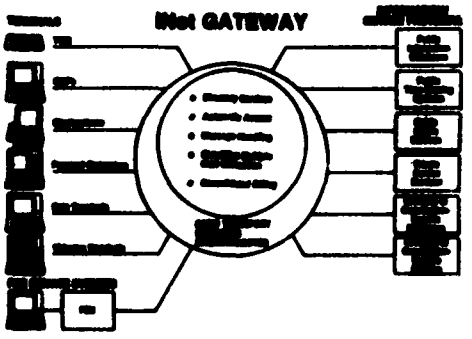
- SINGLE POINT OF ACCESS
- MULTIPLE SERVICES
- MULTIPLE TERMINAL TYPES
- EVOLVING OFFICE COMMUNICATION NEEDS

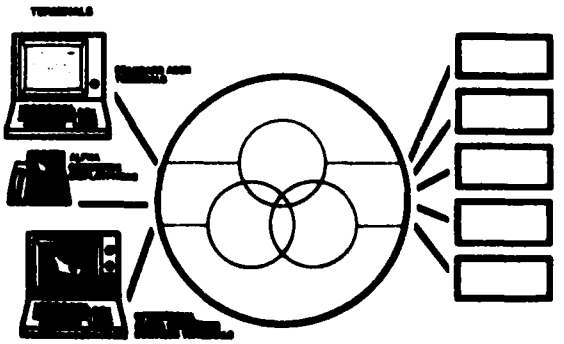
Mist USER BENEFITS

- IMPROVED PRODUCTIVITY
- TIMELINESS
- ONE-STOP SHOPPING
- TERMINAL FLEXIBILITY
- CONSOLIDATED BILLING
- VARIABLE LEVELS OF EXPERTISE

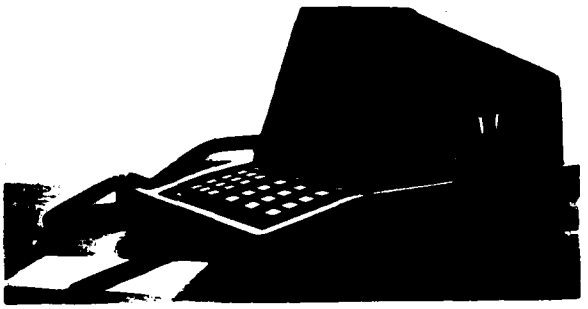
Mist PHASE 1 — FIELD TRIAL

- SUBSET OF SERVICE CONCEPT PROVIDED
- 10 EXISTING SWARMS FROM JULY 1988
- 400 USER CPE
- 20 OPERATIONS/SERVICE PROVIDERS
- SIX LOCATIONS, ORGANIZATIONAL AND PERSONAL DIVERSITIES
- APPEARING ACCESS TO SERVICES





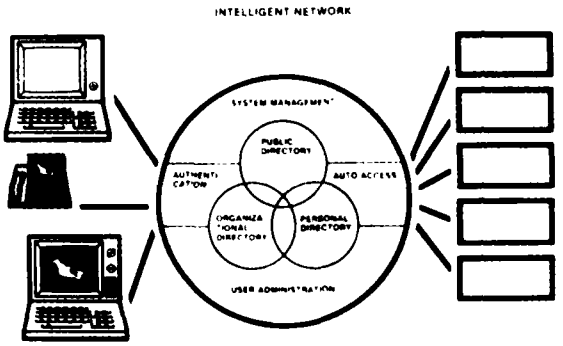
FACILITIES

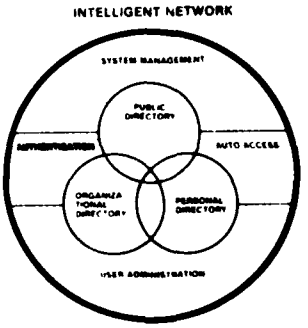


DATAPAC

DIRECT DIAL

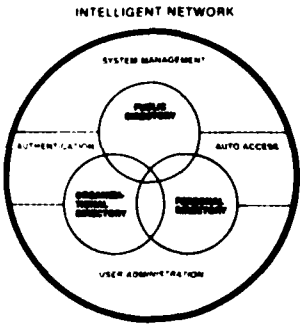
PRIVATE LINE





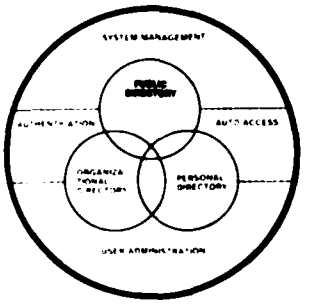
AUTHENTICATION

- identify user
- [illegible] description of user
- personalized interaction
- security procedures
- management control



DIRECTORIES

- catalogues of services accessible via Intelligent Network
- three categories:
  - public
  - organizational
  - personal



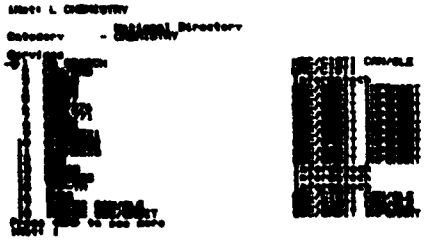
DIRECTORIES
PUBLIC

- list of services accessible by Intelligent Network users
- analogous to yellow pages
- menu selection, keyword searches
- open by all Intelligent Network users

```
Directory command: 1 pub
                Public Directory Categories

  41   CARLETON UNIVERSITY LIBRARY
  42   CASH FLOW
  43   CHEMICAL ENGINEERING
  44   CHEMISTRY
  45   CHEMOTHERAPY
  46   CHICAGO BOARD OPTIONS EXCHANGE
  47   CHILDREN'S LITERATURE
  48   CIVIL ENGINEERING
  49   CIVIL LAW
  70   CIVIL RIGHTS
  71   CLIMATOLOGY
  72   COAL
  73   COAL MINING
  74   COLLEGES AND UNIVERSITIES
  75   COMMERCE
  76   COMMERCIAL AIRCRAFT
  77   COMMERCIAL BANKS
  78   COMMODITY MARKETS
  79   COMMUNITY DEVELOPMENT
  80   COMMUNITY FACILITIES
Enter carriage return to see more

Directory command:
```



```
                National Directory
Category     - CHEMISTRY
Service        1 - CA SEARCH
ABBREVIATED NAME OF SERVICE:

  CA SEARCH
FULL NAME OF SERVICE:

  CHEMICAL ABSTRACTS SEARCH
ORGANIZATION RESPONSIBLE FOR CONTENT:

   Chemical Abstracts Service
   P.O. Box 3012
   Columbus, Ohio  43210
   U.S.A.

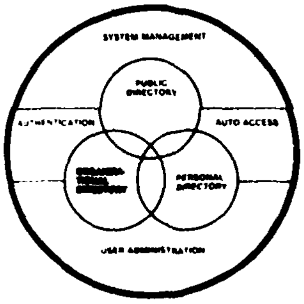
Press <CR> to see more
(more)
DESCRIPTION OF SERVICE:

CA Search cover all aspects of chemistry.  Over 14,000 journals are covered;
as well as patents from 26 countries and two international document offices;
new books, conference proceedings, theses and technical report.  The printed
equivalents are Chemical Abstracts and the CA Volume Indexes.
USER NOTES:

In order to become a CAN/OLE user you must sign a CAN/OLE Purchase Order.
Training course schedule available on request.
```

```
1. Abbreviated Name of Service Provider
2. Full Name of Service Provider
3. Organization Responsible for Service
4. Description of Service
5. User Notes
6. Scope
7. Coverage
8. Services
9. Hours
10. Cost
```

INTELLIGENT NETWORK

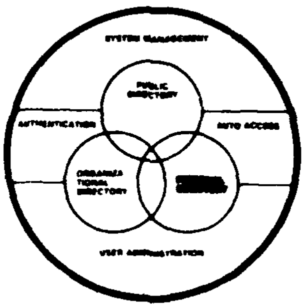


DIRECTORIES ORGANIZATIONAL

- content and structure defined by organizations
- similar to the public directory
- seen only by members of the organization

```
iNet: list org
              Organization Directory Categories
 1  ALL HOSTS
 2  ----------------------------------
 3  BCIS HOSTS
 4  ----------------------------------
 5  SDS
 6  ----------------------------------
 7  ILL
 8  ----------------------------------
 9  MESSAGING
10  ----------------------------------
11  NON BCIS HOSTS
12  ----------------------------------
13  VIDEOTEX
14  ----------------------------------
No more
Directory command:
```

INTELLIGENT NETWORK



DIRECTORIES PERSONAL

- content defined by user
- serial listing of frequently accessed services
- seen only by the user

```
WELCOME - iNet - SIENVENUE
Please enter your user-id
ID used
Please enter your password

LAST LOGON TIME: 1985-09 19  10:47:50

              Personal Directory
   1  DVB
   2  CAN/OLE
   3  CAN/SND
   4  DOBIS
   5  ENVOY 100
   6  VISTA
No more

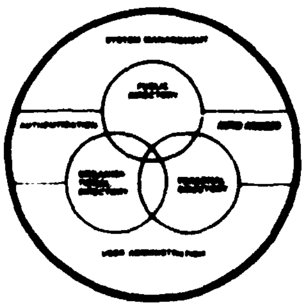
Directory command: 5
ACCESSING FROM PERSONAL DIRECTORY
iNet: Datapac call connected
iNet: connected

Welcome to ENVOY 100! Your last access was
Wednesday, September 18, 1985  2:46 PM

   No new mail.

Command?
```

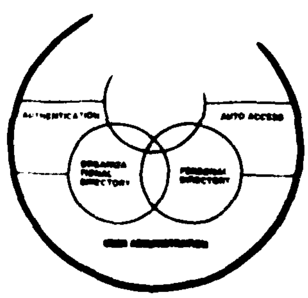
INTELLIGENT NETWORK



AUTO ACCESS

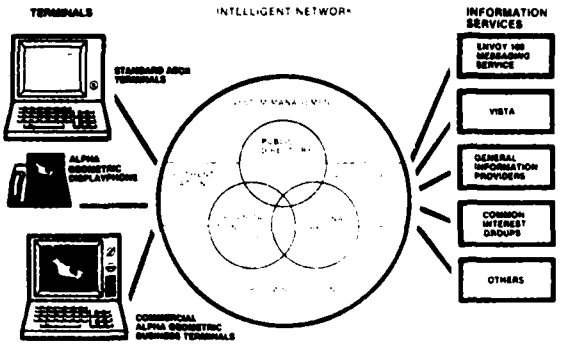
- automatic access and connection to Intelligent Network services

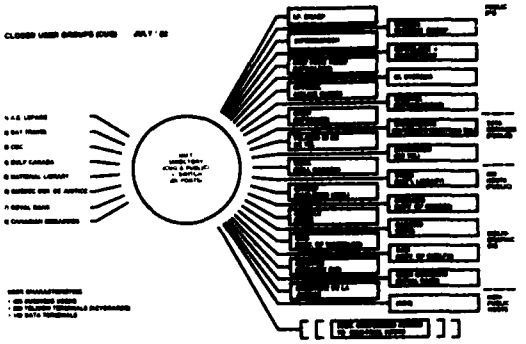
INT



MANAGEMENT AND ADMINISTRATION

- user assistance
- network messages
- network monitoring and diagnostics
- traffic statistics
- user account maintenance





PHASE 1 — ISP'S

PUBLIC ALPHA GEOMERIC HOSTS		TELIDON HOSTS
– I.P. SHARP	– CANADIAN	– VISTA
– INFO GLOBE	– CANADIAN	– DATAMISSION
– NEW YORK TIMES ONLINE	– GATEWAY	– DC TEL
– MAGNETOGRAM	– GUELPH ONLINE	– GRASSROOTS
– GL SYSTEMS	– INRS	– CDS
– INFORMATECH	– CANADIAN COMMAND	– FAXTEL
– CAS	– RADARSAT	– SYS
– CDS	– CAN (WATERLOO)	– TELEMIRE
– ENVOY 100		– CANTEL
– GEISY		– SOC
		– INFLO TEL
		– NOVATEX

(EFFECTIVE FEBRUARY 1988)

PHASE 1 — USER GROUPS

TRAVEL INDUSTRY	GAY TRAVEL
PETROLEUM INDUSTRY	GULF OIL CANADA LTD.
REAL ESTATE	A.E. LEPAGE
BROADCASTING	CBC
FINANCE	ROYAL BANK
GOVERNMENT	CANADIAN EMBASSIES
	DOC
	DRS
	NRCC
LEGAL	QUEBEC MINISTRY OF JUSTICE
	QUEBEC BAR
BIBLIOGRAPHIC	NATIONAL LIBRARIES
	UNIVERSITY OF WATERLOO
	UNIVERSITY OF GUELPH
	UNIVERSITY OF QUEBEC
	CARLETON UNIVERSITY
	NATIONAL RESEARCH COUNCIL

BIBLIOGRAPHIC INTEREST GROUP

PROJECT-
COORDINATOR: NATIONAL LIBRARY OF CANADA
OFFICE FOR NETWORK DEVELOPMENT

PARTICIPANTS: CANADA INSTITUTE FOR SCIENTIFIC AND TECHNICAL INFORMATION (CISTI)
CARLETON UNIVERSITY
NATIONAL LIBRARY OF CANADA
UNIVERSITÉ DU QUÉBEC
UNIVERSITY OF GUELPH
UNIVERSITY OF WATERLOO

INET GATEWAY TRIAL
BIBLIOGRAPHIC INTEREST GROUP PROJECTS

1. SYSTEMS INTERFACE

INET GATEWAY TRIAL
BIBLIOGRAPHIC INTEREST GROUP PROJECTS

1. SYSTEMS INTERFACE
2. DIRECTORIES TO SUPPORT ACCESS TO THE SYSTEMS

INET GATEWAY TRIAL
BIBLIOGRAPHIC INTEREST GROUP PROJECTS

1. SYSTEMS INTERFACE
2. DIRECTORIES TO SUPPORT ACCESS TO THE SYSTEMS
3. DERIVATION OF BIBLIOGRAPHIC DATA FROM NETWORK-CONNECTED HOSTS

iNET Gateway Trial

Bibliographic Interest Group Projects

1. SYSTEMS INTERFACE
2. DIRECTORIES TO SUPPORT ACCESS TO THE SYSTEMS
3. DERIVATION OF BIBLIOGRAPHIC DATA FROM NETWORK-CONNECTED HOSTS
4. USE OF ELECTRONIC MESSAGING FOR INTERLIBRARY LOAN

iNET Gateway Trial

Bibliographic Interest Group Projects

1. SYSTEMS INTERFACE
2. DIRECTORIES TO SUPPORT ACCESS TO THE SYSTEMS
3. DERIVATION OF BIBLIOGRAPHIC DATA FROM NETWORK-CONNECTED HOSTS
4. USE OF ELECTRONIC MESSAGING FOR INTERLIBRARY LOAN
5. VIDEOTEX DATA BASE CREATION

iNET Gateway Trial

Bibliographic Interest Group Projects

1. SYSTEMS INTERFACE
2. DIRECTORIES TO SUPPORT ACCESS TO THE SYSTEMS
3. DERIVATION OF BIBLIOGRAPHIC DATA FROM NETWORK-CONNECTED HOSTS
4. USE OF ELECTRONIC MESSAGING FOR INTERLIBRARY LOAN
5. VIDEOTEX DATA BASE CREATION
6. USE OF INFORMATION PROVIDER DATA BASES FOR INFORMATION RETRIEVAL (ALPHANUMERIC AND VIDEOTEX)

iNET Gateway Trial

Bibliographic Interest Group Projects

1. SYSTEMS INTERFACE
2. DIRECTORIES TO SUPPORT ACCESS TO THE SYSTEMS
3. DERIVATION OF BIBLIOGRAPHIC DATA FROM NETWORK-CONNECTED HOSTS
4. USE OF ELECTRONIC MESSAGING FOR INTERLIBRARY LOAN
5. VIDEOTEX DATA BASE CREATION
6. USE OF INFORMATION PROVIDER DATA BASES FOR INFORMATION RETRIEVAL (ALPHANUMERIC AND VIDEOTEX)
7. PROTOTYPE BIBLIOGRAPHIC FILE TRANSFER

iNet PHASE 2 — MARKET TRIAL

GOALS AND OBJECTIVES

- 1000 USER ID'S
- [illegible] PUBLIC INFORMATION/SERVICE PROVIDERS
- AUTO ACCREDITATION OF ALL USERS TO ALL PUBLIC ISP'S
- BILLING SYSTEM FOR iNet AND ISP USAGE

PHASE II TARGET MARKET

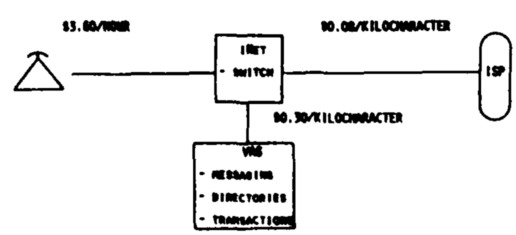
- BIBLIOGRAPHIC
- LEGAL
- BANKING
- REAL ESTATE
- TRAVEL
- GOVERNMENT
- SCIENTIFIC
- AGRICULTURE
- HOME COMPUTER USER
- MEDIA & COMMUNICATIONS

APPLICATIONS DEVELOPMENT AREAS

- SCIENCE AND TECHNOLOGY
- BUSINESS AND FINANCE
- GOVERNMENT AND POLITICS
- INFORMATION AND COMMUNICATION
- EDUCATION, LAW AND HUMANITIES
- RECREATION, ENTERTAINMENT AND TRAVEL
- GEOGRAPHICAL LOCATION INFORMATION

iNET 2000 MARKET TRIAL RATE PLAN

USAGE CHARGES



SHARING COMMAND LANGUAGES AND SOFTWARE

LANGAGES DE COMMANDE ET LOGICIELS PARTAGES
Monsieur Pierre BUFFET
TELESYSTEMES-QUESTEL
40, rue du Cherche Midi
75006 PARIS - FRANCE

Résumé

I. - INTRODUCTION

Le besoin en matière de portabilité de logiciel de recherche documentaire et de compatibilité de langages d'interrogation est apparu à la suite :

- de l'utilisation en réseau des serveurs,
- de l'utilisation d'ordinateurs non compatibles, en particulier dans le cadre des travaux entre le Centre de Documentation de l'Armement (CEDOCAR) et TELESYSTEMES-QUESTEL.

Ceci a conduit à la définition et l'écriture d'un nouveau logiciel : QUESTEL PLUS.

II. - LANGAGES D'INTERROGATION

La présence sur le même serveur de plusieurs applications (recherche documentaire, recherche structurale en Chimie, ...), la multiplicité des langages (DIALOG, ORBIT, STAIRS, ...) et les tentatives de normalisation (Common Command Language de la C.C.E.), ont permis la définition d'une structure de logiciel rendant indépendants le langage propre de gestion et de communication et un ou plusieurs langages externes tels que : QUESTEL-anglais, QUESTEL-français, CCL, Videotex. Cette notion peut être étendue à l'échange d'information entre sites serveurs et concentrateurs intelligents ("gateways").

III. - LOGICIEL PORTABLE

Pour assurer la portabilité du logiciel, deux techniques complémentaires ont été retenues :
- l'emploi d'un langage portable de haut niveau,
- la localisation précise des interfaces avec le système d'exploitation et le système d'entrées-sorties.

III.1 Langage de développement

A été retenu CPL/1, sous ensemble de PL/1, car il bénéficie sur de nombreuses machines de compilateurs de qualité (ni PASCAL, ni ADA n'ont pu être choisis à l'époque).

III.2 Interfaces systèmes

Pour rester portable, le logiciel ne doit pas faire directement appel aux fonctions des systèmes d'exploitation et d'entrées-sorties, mais doit faire appel à des fonctions standard, regroupées en deux bibliothèques d'interfaces spécifiques sur chaque ordinateur. Seuls ces modules sont réécrits.

III.3 Portabilité

Il a été possible d'obtenir les chiffres de 90 % du logiciel en langage portable, et 10 % en modules spécifiques.

I. - INTRODUCTION

The concept of automated information delivery is relatively new. Roughly speaking, during the sixties, the major problems to be solved were to produce automated catalogues in libraries ; and to photocompose bulletins, or to generate large indexes in abstracting and indexing services.

One of the first services available through the computer was that of selective dissemination of information - SDI -.

Then, late in the sixties, two major technical host computers - namely LIS, LOCKHEED Information Services from LMSC, LOCKHEED Missile and Space Company, and ORBIT Search Service from SDC, System Development Corporation - appeared in the United States. One host computer was installed in Europe in the context of ESRO, the European Space Research Organization, because of the relationships of this organization with the NASA.

At this time, a user, librarian or information scientist, had to learn two languages, RECON and ORBIT, to access the major international data bases, in particular in Engineering and related disciplines. Later, new vendors gave worldwide online access to new files, e.g. BRS (Bibliographic Retrieval Services) in the States, and the EURONET Hosts in Europe, representing ten online services, offering access to hundreds of databases (1). This paper will try to explore some solutions for simplifying this access in terms of command languages. The concept of portable software will also be examined, as providing the opportunity to share the same language on various computers.

II. - THE SCENE IN THE EIGHTIES

It is commonly accepted that a user is accessing more and more different online services, six being estimated as an "average". Even if it can be considered that there exist families of search languages (e.g. RECON with DOE/RECON, NASA/RECON, DIALOG, ESA/QUEST, ORBIT with SDC/ORBIT and NLM/ELHILL, STAIRS with BRS/STAIRS), the customer is in trouble when he wants to access more and more factual data banks attached to dedicated softwares.

To try to understand the different facets of the problems which can be encountered, it can be interesting to list the various actors of the information industry.

II.1. The kind of information to be accessed

There are collections of numeric and/or textual information processed by publishers or organizations in computer readable form. Apart from numeric and bibliographic files, that will remain important, for instance when large disciplines such as chemistry are considered, full text (e.g. for technical reports), drawings (e.g. for Patent material or for chemical structures with CAS ONLINE and DARC Systems), and images (technological data) must be foreseen. These representations of information will be processed and distributed using new technologies. The U.S. Patent and Trademark Office Automation Master Plan for the period 1983-1990 (2), is an excellent example of what should be a paperless integrated system. The logical consequence is an impact on the software capabilities (new functionalities) and on the organization of information transfer (role of each intervening party).

II.2. The users

To be able to fit user needs, any system designer must be aware of the basic problem : which information, for who, through which channel. To help this system designer, categories may be established : users attached to the discipline or industrial sector they are involved in, to their level of education and to their mother tongue. Today, most people are able to dial a telephone number, more and more accept the concept of a terminal, but the keyboard can raise difficulties ; the French electronic directory is a good example, and there were numerous discussions about the choice of an alphabetic keyboard (instead of AZERTY or QWERTY) and its adequacy.

II.3. Hardware and software

The impact of the evolution of hardware and software technologies is very important. It must be emphasized that hardware is moving much faster than software. The first version of RECON is from the second half of the sixties, more than 15 years old. During this period, the CPU became 10-100 times more powerfull, the mass storage 10-100 times larger. 50 mips machines are for tomorrow ; some are speaking of 1 000 mips...

The only limit that should be kept in mind is that of a channel rate with a maximum of 10 times : this will probably influence system architectures in the near future (parallel processors, distributed hardware). Another problem that shall remain is that of compatibility of equipment, amplified by networking.

II.4. Networking

This is the condition "sine qua non" for having effective access to large databases. The real expansion of host usage started with the generalized availability of non dedicated networks making the connect time rate reasonable. As these networks become more and more sophisticated, the influence on retrieval systems becomes more obvious. This is especially true when Videotex applications are concerned. It is interesting to see that, for instance, in European countries, the Videotex systems emerged from PTT's organizations and that, even if the concept of the host remains distinct, there exist more and more intelligence at the level of the network, in concentrators, in managing centers or in gateways.

II.5. Standardization

The field of information is especially concerned by the concept of exchange, and the consequence is a strong need for standardization.

This concerns the information itself, its coding, the related tools and all the computerized environment. For this purpose, several organizations are involved, such as CCITT for telecommunication, ISO (International Standard Organization), especially technical committies TC 97 computer sciences and TC 46 documentation.

III. - THE LANGUAGE BARRIER

Language should mean communication interfaces and, in pratice, represents barriers. This well known paradox reflects the reality : a language is a compromise between the differences between human beings and the standard needed for the transfer of information to a maximum number of people. This is true for natural tongues and this remains true for artificial languages. Each artificial language, especially a command language or a programming language, contains its limits.

Thus, the problem to be solved, both for searching databases and for implementing corresponding softwares, is to optimize this compromise between the universal language designed for any data, for any user, running on any hardware, and the highly sophisticated software understood by less than 10 people, ... including the designer. To be effective, a solution consists of trying to correctly define the information to be handled (text, numeric, drawings, ...), the functionalities needed to suit the requirements (searching, displaying, computing, transferring data, ...), the various categories of users who may access the information, and last the possible hardwares to be used.

A study, sponsored by the COMMISSION OF THE EUROPEAN COMMUNITY, NETSERV 2(3) whose aims were to analyze the problems of the European users facing the heterogeneous host of EURONET-DIANE, stated the following :

- promote all work on standards,

- encourage the implementation of CCL, Common Language (4) as a standard on the Diane Hosts.

- study the feasability of a "DIANE Concentrator" to assist the user when logging in with menu driven techniques, similar to those used in the Videotex applications.

- study the feasibility of regional services, or regional hosts adapted to local needs, in combination with normal hosts as they exist today.

- further investigate the possibility of defining an intermediate language describing the possible exchanges of data between equipments connected to the network (host/host, host/concentrator, host/common service, common service/concentrator). This should allow :

. common language translation to enable unexperienced users to access information in a different, much simpler way.

. search strategy transfer.

. distributed processing (search on host 1, compute on host 2, edit on host 3).

. videotex handling in general.

. electronic mail and computerized conferencing interfaces, e.g. for database production.

The broad conclusion is that on a network, a variety of users accessing a variety of data must be accepted.

IV. - THE TELESYSTEMES EXPERIENCE : THE QUESTEL PLUS COMPROMISE

QUESTEL-PLUS © is the new product developped by TELESYSTEMES in collaboration with INFORMATECH (Canada). The need for a portable retrieval software initially occurred in a network environment with different computers, especially for INFORMATECH (portability on IBM) and for CEDOCAR, the French Centre de Documentation de l'Armement (portability on Honeywell Bull - DPS 7 hardware).

IV.1 QUESTEL PLUS IS A LANGUAGE

The presence of several packages on the same host (bibliographic retrieval, substructural search in chemistry), the variety of search languages available (DIALOG, ORBIT, STAIRS, ...), the attempts for standardization (CCL of CEC), the evolution towards distributed resources, led TELESYSTEMES to define a software architecture making independant the internal language for management and communications, and one or several external, user oriented, languages for searching.

Today there exist or will exist soon :

- QUESTEL-English, QUESTEL-French, QUESTEL-German

- VIDEOTEX-French, VIDEOTEX-English

- QUESTEL-SYDONI, CCL

amongst which VIDEOTEX-French and QUESTEL-SYDONI correspond to very different search languages. For the first, the handling of function keys and of tree structure is real, for the second, a set of macros was developped.

Besides, when new fonctionalities are added, the implementation is simpler. An example is the extension of the simple SHOW command for displaying hits on-line to 3 commands :

- standard SHOW command for displaying a list.

- BROWSE facilities on answer lists or external devices (images or drawings linked to answers).

- ZOOM command for displaying accurate passages (3, 4 or more lines), sentences or paragraphs within lengthy documents (the relevant words can be highlighted).

Another example is the possibility of extracting subfiles from a search, for downloading or for processing by other systems. This capability is, in some respects, an extension of the present DARC QUESTEL interface.

IV.2. QUESTEL-PLUS IS A PORTABLE SOFTWARE

Two complementary techniques are mandatory for making sure of the portability, i.e. to transfer the software on a different hardware at a reasonable cost. These two techniques are : the use of an appropriate portable high-level language for developing the programs on one hand, and a clear identification of interfaces with both the operating system and the I/O devices on the other hand.

IV.2.1. Use of a portable high level language

The basic principle is that the compiling is done in 2 different steps. The first consists in syntactic and semantic analysis, intermediate code generation, printout lists. This phase is fully independant of the computer kept for implementation. The intermediate language is also independant.

The second step is the assembler source code production for the target computer. It is also possible to keep this phase on any computer using direct assembling on the object machine or cross assembling on another computer.

IV.2.2. Language selection

The high level language selected is CPL/1 for the following reasons :

- this is a subset of PL/1 broadly known and used.
- there exist good compilers for producing the target code from the unique source code, especially on HONEYWELL Mini 6, DPS 7, DPS 8, IBM 43 XX and IBM 30 XX, Dec Vax.
- these compilers are largely disseminated, and consequently well maintained.
- it is not necessary to develop particular compilers.

These reasons explain why neither PASCAL, nor ADA were selected, because at the time of choice (end of 1980) there were no effective tools for these two languages.

IV.2.3. System-Interface

Any package requires functions of the Operating System and of the I/O devices. Frequently, these functions are quite different from one computer to another computer, or even from one version to another version of an operating system. So, to remain portable, and to be able to follow the system evolution, a package must not use these functions directly, but must use standard functions arranged in 2 interface libraries :

- LOS (Logical Operating System)
- LAM (Logical Access Method)

These libraries are specific for each computer. They provide the link between the package and the system, and thus are written in assembler. Only these libraries are to be rewritten when a new computer is to be installed.

V. - CONCLUSION

QUESTEL PLUS is actually developed today on an IBM mainframe and is installed on IBM (4341-2, 8 Mbytes main memory, 25 Gbytes disc drives, 3081) and is to be implemented soon on DPS 7/82, 8 Mbytes, 20 Gbytes disc dirves). The first results are very encouraging, especially concerning the efficiency of the package. This should demonstrate that it is feasible to have a portable system open to distributed techniques, multilingual access, able to manage very large data bases (several million documents in a data base, several indexes of several million terms each, up to 250 different labelled fields in a document, up to 250 paragraphs in a field, up to 250 sentences in a paragraph, up to 250 words in a sentence).

It is important when the concepts of gateway, Videotex and host are converging, to have the basic tools ready for upgrading information delivery.

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Word Processors in Aerospace/Defense Information Services: Use of Distributed Information Systems by the Office of the Secretary of Defense

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As indicated in the program abstract, the purpose of this paper is to describe the utilization of word processing and distributed information systems within the Office of the Secretary of Defense (OSD).

Like most organizations, the Office of the Secretary of Defense (OSD) can be described in terms of purpose or mission, assigned responsibilities, specific functions, and resources. By definition, the Defense Department is responsible for providing the military forces needed to preserve peace and protect the security of the United States and its Allies. Under the President, the Secretary exercises the direction, authority, and control over the Department which includes OSD, the Joint Chiefs of Staff, the Military Departments, various unified and specified Commands as well as several Defense Agencies.

Should this sound very "Military" and unlike civilian industrial organizations, it should be noted that the OSD is the principal management staff of the Secretary in the exercise of:

* Policy Definition
* Planning
* Resource Management
* Program Evaluation
* Fiscal Evaluation

Thus, there are in fact certain general management functions that are common to both OSD and to many "civilian" industrial organizations.

Most of you represent Aerospace industries within NATO countries. It may be helpful, in order to demonstrate the applicability of our experience with distributed information systems for management support, to further indicate some analogies between OSD and the kind of industrial organization and structure that you are perhaps most familiar with.

The Under Secretary of Defense (Policy) is responsible for integrating DoD plans and policies with overall national security objectives. Certainly the Aerospace industries have a market assessment and product planning function that is integrated with corporate objectives.

Just as the Aerospace industries have Research and Engineering programs, so is the Under Secretary of Defense (Research & Engineering) within OSD responsible for defining basic and applied research programs and the management and evaluation of newly emerging technology.

Aerospace industries have their Budget and Finance Divisions - OSD has an Assistant Secretary (Comptroller) for exercising financial control. In a similar way, functions related to Personnel, Supply or Logistics, Health and Environmental Affairs, Public Information, Program Audit, Quality Assurance, and Legal Affairs can all be found within OSD and exercised somewhat similar to industry procedures.

The real common denominator in the management of both military and industrial programs, however, is "information" - information that is accurate, up-to-date, specific, yet comprehensive - information that is needed to assess and evaluate programs and to make better, more informed decisions.

Yet, much of the management or "program" information used by OSD is processed in much the same way as it was years ago - by typewriters, mail, and couriers. Program information is assembled at the Military Department, Command, Laboratory or Agency Level, packaged into neat typewritten reports, and forewarded to the appropriate counterparts within OSD for review, assessment and revision or approval. Frequently that information is returned, however, to the Military Departments, Commands, Laboratories or Agencies for redefinition, reassembly and repackaging for further review at the OMB and/or Presidential Level. And so a whole sequence of changes, revisions and reassembly of programs occur - usually with severe time constraints and shortened due dates.

It is this process of information acquisition, exchange and utilization that we are concerned with and are trying to find ways for simplifying the process while improving the quality of information available within a given time frame.

Before "reforming" the DoD world, however, we must first "reform" our own OSD Community, at least as far as management information is concerned. Since much of the information processed is typed - and retyped, perhaps several times over, word processing was an obvious candidate for improving the use of information as a management resource. Thus in the late 70's, use of word processing equipment became a requirment. Other requirements were defined as well. If a terminal could be used for word processing, why not data processig as well - and Electronic Mail, and Graphics, and Financial Modeling. Thus was the concept of an integrated network of word and data processors defined for OSD.

The principal architect of the system concept was a young man named Paul Tisdale. As the Deputy Director of Computer and Office Automation Resources (DCOAR) for OSD, Paul conceived the use of standard, off-the-shelf hardware that could be used for a wide range of information processing functions - all within the same unit, terminal or work station. The Director of DCOAR, Mr. Charles Lawson, shared the same views of the future as Paul, and together they proceeded to make the necessary decisions and obtain the funding needed to fully implement the system.

In retrospect, for their foresight, vision, and willingness to make high risk/high dollar decisions they deserve much credit as pioneers in the use of word processing and distributed processing technology within the Defense Community.

It was agreed that initial operations would be limited to a prototype system within OSD's administrative offices - those primarily concerned with personnel, financial programs, and inventory controls. The concept was to utilise a combined system that would provide word processing, data processing, graphics, electronic mail, and financial modeling all within a single system. In addition, the concept of distributed processing was to be employed - the use of shared data files and on-site terminal processors with immediate access to programs, files, data - and results in the form of terminal displays or local, on-site printer listings. This was intended to bring the results of computer processing directly to the user who could interact with the system "one-on-one" without delays, programmers, or other computer middle men or intermediaries.

At the time this was rather radical thinking - far different from the traditional way of doing things. Until then, most of the OSD staff had received data processing support from one of our support organizations, the Air Force Data Services Center (AFDSC). For the most part, that implied time-shared use of fairly large, complex systems that required a good bit of technical assistance in their use. In some instances, system applications were "batch processed", the user submitting a job request and subsequently getting a listing or report of a later time depending on the individual job's priority and how it compared to other tasks within the job stream.

To be sure, the AFDSC did, and still does, an inordinate amount of data processing for OSD. Representing a capital investment of over $32 million in hardware alone for 35 major systems, the Center is one of the largest data processing centers in the world. Supporting over 6000 registered Air Staff and OSD users with 1700 terminals, the Center utilises 87,000 magnetic tapes, nearly 1000 disk packs, and 164 billion bytes (characters) of combined memory, disk and mass storage! This will probably double to 400 billion bytes within the near future.

OSD utilization of these systems is only 12% of the total; most of the systems use is by the Air Staff. Yet within that 12%, OSD accounts for nearly:

18 million records
4800 computer programs
150 major software systems, and
2,000,000 lines of code

A staff of nearly 100 AFDSC programmer/analysts are used solely by OSD to keep things running - not to say anything about additional operations support personnel.

And so the traditional systems supporting OSD, at an annual direct cost of about $4 million, are fairly extensive, complex, and expensive.

Utilization of distributed processing systems was to be an alternative to continued, wide-spread use of large-scale, time-shared systems. Of course, there would always be use for some large-scale processing - dictated by the size of the problem or the extent of the system application. But here was a new concept, a new approach to bring computer and word processing capability directly to the user for immediate access, use, feedback and reuse.

It was this interactive dialogue between system and user with immediate on-site output displays or listings that appeared so desirable. And, of course, the possibility of using the same device for both word processing and data processing was highly promising. The availiability of higher level languages also appeared attractive as a possibility of future users developing their own programs.

An additional objective, an expected by product of the network, was the capability to modularly expand, or contract, or change the shape of the network as workloads dictated. This, in theory, would obviate the need for time-consuming and costly "system conversions" and "upgrades". As workloads increased, or new applications were defined, it would be rather straightforward to merely add an additional processor(s) wherever needed. This would potentially have significant cost savings over the life of the system, and substantially support system continuity and software standarization.

The potential for using electronic mail as part of the management review process was also a primary objective.

These were some of the basic considerations and general requirements for acquisition of a prototype system. Accordingly, a market survey was conducted which included consideration of several systems. Only the Datapoint ARC (Attached Resource Computer) met all of the minimal requirements.

Initially, a standard configuration included a CRT/Processor and associated printer equipment. Each processor contained a 128KB or 256KB memory. Each processor in turn was linked to other processors and remote data files by coaxial cable. Other hardware, called "rims and hubs," acted as specialised communication links enabling one device to "talk" to another. Data is moved over the cable at rates of 2.5 million bits per second. The system, which is "memo" driven, provides the user with a choice of options or functions to be performed, and provides access to remote data files and programs which are then transferred to the processor for execution. Remember that the processor is at the user's desk or office. As results of the processing occur, they may then be immediatly displayed or listed via the on-site printer.

Over a period of a year, the prototype system expanded to include a broad range of applications. Some applications were "one-of-a-kind," others were standard applications that could be shared with may users from different organizations. Common or standard applications included:

Correspondence Control
Calendar Scheduling
ADPE Inventory Control
Procurement Tracking

Other unique administrative applications included:

Space Management
Personnel Applications
Program Budget Evaluation
Training & Career Development
Manufacturing Technology
Export Case Controls

Perhaps another 30 applications were developed largely of an administrative or management nature. All of these were unclassified and could share the remote disk files. But a good bit of OSD's work naturally was classified and demanded the use of a secure system. As a result, this would impact the equipment configuration and lead to the development of "local area nets" - the second and continuing phase of our present system development.

Most of you may know that all electronic equipment carries its own electromagnetic signature - and as it performs or manipulates data an electronic pattern is emitted which conceivably could be monitered. For that reason, there are security standards that electronic equipment must meet if it is to process classified data.

We are just now concluding a year long competitive process that will award a contract for modifying and securing Datapoint equipment. First deliveries aren't expected before December of this year. That configuration will permit "stand-alone" processing units which may or may not be linked to other units in a compartmented "local area net". The stand-alone configuration will include the CRT/Processor - with 256KB - and eventually 512KB, along with a printer, two to four satillite "dumb" terminals as well as removeable discs and a tape cartridge. The tape cartridge can store up to 10MB, and the disk subsystem is expandible to 100MB. Thus the "secure" system will be able to perform as a completely self-contained unit or could be linked to other secure units in a

"local net." Of course, with adequate precautions, the secure systems could also link back into the unclassified net to retrieve information or programs. More than likely, however, there will be a distinct separation of the systems.

As previously indicated, however, secure Datapoint systems are not yet operational. Their unavailability over the past 2 years severely stressed a number of OSD organizations that had immediate needs for secure word processing equipment. Staffing and clerical support in OSD has always been restricted - and there seems always to be more work to go around than available staff to assist. With the ready availability of word processing equipment commercially, there was significant pressure from the OSD staff to immediatly respond to legitimate needs and to provide secure word processing systems.

At the time the decision to consider some limited diversification of equipment was considered, a number of factors related to the Datapoint prototype were taken into account. Comparisons of Datapoints' word processing system with those of other vendors who specialised in word processing, indicated a number of shortcomings. The Datapoint system required extensive use of "codes" rather than function keys. This placed an extra burden on the typist for remembering the codes. Both "Block" and "Line" manipulation was limited, and spelling errors were not identifiable thru a resident dictionary. It appeared that the word processing package just wasn't as "user friendly" or as sophisticated in terms of capabilities as other systems that were primarily word processors only.

Another factor in consideration at the time was the rate of technology change. As each new product line was announced by one or another vendor, startling new capabilities were advanced that made each system more attractive than its predicessor. Datapoint also continued its efforts at product improvement, and now has as new word processing package in "Beta" test due for general release later this fall or winter. First indications of the package are that it represents a substantial improvement and will be highly comptitive with other vendor products.

Competition itself, we have always believed, fosters new product devlopment and the best possible price. Accordingly, a general position was adopted that would continue to provide for a "standard", "off-the-shelf" word processor/data processor system, i.e. Datapoint, but also allow for limited diversification depending on the unique functional requirements of a given office. This has resulted in a substantial draw down from 8 or 10 vendors being used to approximately four major ones including Datapoint. The others are Lexitron, Xerox and Lanier. The reduction in vendors was due partly to selected vendors' ability to meet specific functional requirements, and their ability to immediatly provide secure equipment.

What will the impact be of this diversification? Although we can anticipate some good from it - responsiveness to unique user needs, continued product improvement due to competition, ect., we can also anticipate a number of problems. Even though some OSD suborganizations can operate on an individual basis without much need on opportunity to "communicate" with each other, most organizations are mutually dependent - or at least must consult with each other on a wide range of topics. Thus the introduction of diversified word processing equipment brings with it a list of "compatibility" problems. None of the equipment is "compatible" or interchangable, or interconnective. So, of course, one of our immediate "R&D"tasks is to see how these different systems can be linked together so they can communicate with each other. With diversification, of course, we also acquire multiple training problems, and lose some of the flexibility of being able to readily move clerical support from one assignment to another. With the acquisition of each vendor's equipment, we also acquire unique maintenance problems, and the need to provide operational support and "hand holding" based on different equipment configurations.

From the users point of view, this is the best of all possible worlds, i.e. he/she has a unique piece of equipment which directly matches their immediate information needs. From the data processing manager's point of view, life has become more complicated, albeit with presumably happy customers.

And what of the future? Just briefly, you can say that it will be one of the most exciting periods in the history of computer technology. OSD will support and encourage major efforts in the following areas for potential support of managers and decision makers:

- Optical Laser Disc Systems - for storage and retrieval of visual images, photos, graphs, cortographic or engineering drawings as well as textual information.

- Broadband Video/Digital/Voice Communication Nets - for improved teleconferencing, information exchange and collective decision making.

- Portable Minicomputers - for teleconferencing immediate access to data resources, improved productivity and creativity thru exploiting one-on-one compute capabilities.

- Artificial Intelligence Systems - that will assist in evaluating alternatives, identify and select associative patterns or trends, and draw possible solutions for given problems.

- Special Purpose Computers - for building data files and enabling direct retrieval of textural or numeric data.

- Natural Languages - use of ordinary, if structured, language to enable non-technical persons to move readily use computers.

Of these six technologies, all are being actively persued and will become a reality within the near future. Two of the technologies are already available, portable minicomputers and the special purpose computer for retrieval, and are being used by OSD an operational test environment.

The rate of technology changes forces all of us to be sufficiently flexible that we can accommodate "change" and exploit it to the fullest. It also has a commensurate responsibility that we do a certain amount of "missionary" work among our users and managment staff so that they can understand the new technology and be prepared to fully use it. For it is only in improved decision making, individual productivity and creativity, that we can with assurance say,that technology is the promise of the future and capable of bringing people together in the cause of a better, more secure and peaceful world.

Scientific Numeric Databases

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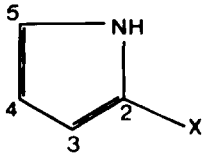
Summary

Scientific numeric databases (SND) are powerful, relatively new research tools for the scientific and technical community. This paper illustrates their use by some practical examples, describes the attributes and capabilities of such databases and gives a survey of the activity in this field. SND permit the direct location, retrieval and the subsequent analysis/manipulation of evaluated numeric data. Advances in telecommunications and increases in the number and types of SND produced greatly enhance the likelihood of relevant data being readily available. Although only 5% of all databases accessible online in North America and Europe are SND, they are growing in importance and acceptance as more databases are developed and scientists and engineers become aware of their potential. The National Research Council of Canada is active not only in the production of SND, involving some international collaboration, but also in their dissemination by means of a nation-wide online packet-switched network.

I Introduction

To appreciate the power and usefulness of scientific numeric databases (SND) as research tools for scientists and engineers it is helpful to consider some fairly typical questions which might be posed to scientific information personnel:

1. Data are needed on as many compounds as possible in which a pyrrole (C_4H_5N) ring appears. Any ligand (X) may be substituted for one of the hydrogen atoms attached to one of the carbon atoms 2 or 5. In particular, how does that carbon-nitrogen bond length and the carbon(2)-nitrogen-carbon(5) angle vary with the ligand X?



2. The analytical laboratory has an infrared spectrum of an unknown substance. To help identify that substance, is there any way they could compare its spectrum to the spectra of a large number of known compounds?

3. A measurement of the specific heat of gadolinium oxychloride at 720K has just been completed. How does that measured value compare with the best published values at corresponding temperatures?

Questions 2 and 3 could be answered by manually searching appropriate atlases of spectra and handbooks respectively, but answered more efficiently by the use of an SND. A scientific numeric database is the only practical means of tackling question 1. These questions will be considered in more detail in Section III where it will be shown how SND's can be used to solve these and related problems in a cost-effective manner.

Whereas most scientists and engineers are familiar with the computer as a means of performing calculations, automating measurements or searching large bibliographic databases, relatively few are familiar with the computer as a means of access to evaluated scientific data from the world's literature. By gaining some insight into the capabilities and benefits of SND's, information specialists can serve as catalysts in bringing about a profitable interaction between scientists, engineers and scientific numeric databases.

Section II defines some basic terminology and gives some perspective on SND's in the context of databases in general. Section III illustrates some of the capabilities and benefits of SND's. Section IV is a brief scan of some recent worldwide advances in the areas of telecommunications and database development. Section V, a survey of some of the SND activity in Canada, concludes the paper.

II Definitions

The classification scheme used in the "Directory of Online Databases"[1] is adapted here to describe the various types of databases in existence.

A. Reference/Source Databases

Reference databases are those which refer or point a user to another source, often a document, for more details or the complete text. This group may be further broken into two categories: Bibliographic (containing primarily citations to published information like journal articles, reports, patents, dissertations, conference proceedings and books) and Referral (containing primarily references to non-published information sources like organizations, individuals, audiovisual materials and non-print media).

Source databases, containing complete data or the full text of the original source information, are conveniently categorized as Numeric, Textual-Numeric and Full-Text. Numeric databases contain original and/or statistically manipulated representations of data; Textual-Numeric databases contain a mixture of numeric data and related textual information; Full-Text databases contain records of the complete text.

B. Scientific Numeric Databases

Primarily source databases, scientific numeric databases are an ordered collection of numbers whose values:

1) correspond to various properties, parameters or attributes of elements, substances or systems

2) are critically evaluated by experts prior to their being included in the database.

Good scientific numeric databases are therefore much more than mere compilations of numbers. The important, and expensive, function of review and evaluation, which is not often found in reference databases, serves to make the data more reliable than those found in the open literature and more useful because of the rationalization of factors like uncertainty statements and units of measurement.

Some feeling for the relative abundance of scientific numeric databases may be gained from the following table (based on entries in reference 1):

Database Type	Science/Engineering		Other		Total	
	1982	1983	1982	1983	1982	1983
Source	67	86	630	977	697	1063
Reference	160	198	346	472	506	670
					1203	1733

Thus, in 1983, source databases in the science and engineering disciplines represent only about 5% of the total, down somewhat from 5.6% in 1982. Not all of these science or engineering source databases would strictly qualify as scientific numeric databases nor, of course, are databases listed that are under development but not publicly available.

C. Scientific Numeric Database Systems

To avoid confusion, the term scientific numeric database system should be used to describe a set of one or more scientific numeric databases combined with a suite of computer programs enabling the scientist or engineer to search the database(s), retrieve items of interest and manipulate those items in a variety of ways. Using a scientific numeric database system is therefore much more than electronically flipping through a handbook to find a specific entry as the next section will illustrate.

III Capabilities and Benefits

The utility and cost effectiveness of scientific numeric database systems (SNDS) can probably best be illustrated by considering the three questions posed in the Introduction.

To the best of the author's knowledge there is no practical way to solve question 1 using bibliographic reference databases or hardcopy reference tools apart from an incredibly exhaustive literature search and a great number of manual calculations. With the aid of an SNDS like the Cambridge Crystallographic Database[2], however, such a problem may be solved in one or two hours in a straightforward, systematic way. One need only describe the chemical connectivity of the pyrrole fragment and ask the system to check that connectivity against the connectivity of all the compounds in its collection. The output of that search, a listing of all the compounds containing a pyrrole fragment, may subsequently be operated upon by a built-in program to execute the required geometric analyses.

Question 2 could be solved in a brute-force way, of course, by manually searching through compilations and atlases of infrared spectra and looking for one that resembles that of the unknown at hand. An improvement on that would be a manual system such as, for example, the "Spec-Finder" marketed by the Sadtler Research Laboratories[3]. In this system, the spectrum is divided into 27 intervals and the strongest peak or band, if any, in each interval is coded. An index ordered by the strongest peak overall then points the user to the spectra in

that firm's spectra collections most closely matching the unknown. A further improvement is gained by the use of an SNDS like FIRST-1[4], SPIR[5], IRGO[6] or IRIS[3] all of which use a database of spectra compiled by th American Society for Testing and Materials. In these systems, the spectrum is coded in terms of its peaks, bands and no-band regions and entered into the computer to form an electronic "mask". This "mask" is then automatically compared with the large number of spectra (about 140,000) in the database and the user is presented with a list of the target compounds having spectra most closely resembling that of the unknown. In most cases the user must still consult a hardcopy of the known spectrum for detailed comparison. Nonetheless a considerable amount of time has been saved and the user is confident that the search has been as exhaustive as currently feasible.

Question 3 could be addressed by consulting handbooks of thermophysical data subject to the usual constraints of actually finding the most recent volume. Even if that constraint is overcome and a value for the compound of interest is found, the probability is quite high that the cited value will not be at the temperature of interest nor in the appropriate set of units. By invoking an SNDS like FACT[7], TBANK[8], or THERMODATA[9], for example, a user has immediate access to a fairly exhaustive set of the most recent data. More than that, the user will be able to ask the system to interpolate between the values of the specific heat at various temperatures to give an estimate at the temperature of interest in the appropriate energy units.

A. Capabilities

Against the background provided by this set of examples, it is now useful to sketch the range of functions that SNDS's can perform.

1. Retrieve items quickly, exhaustively and accurately from large collections of data. Retrieve along lines of thought for which compilers could not have foreseen the need for an index. Retrieve types of information too detailed and tedious for the human mind to readily handle (eg. the connectivity search described earlier).

2. Manipulate and analyze the data in a variety of ways, for instance:
   a) fit curves to quantify relationships
   b) interpolate or extrapolate to facilitate comparison of new measurements
   c) generate graphs of trends or make statistical comparions
   d) produce plots of molecular geometry

3. Simulate experiments with mathematical models, exploring processes like chemical reactions theoretically, thereby often obviating the need to perform the actual experiments or build prototype equipment.

4. Formulate new ideas from observations and statistical inferences on the data themselves. The Cambridge Crystallographic Database is a large body of reliable, basic data and authors have used it to gain information on the effects of substituents, on chemical reactivity, on molecular flexibility and intermolecular forces (see eg. 10, 11 & 12).

B. Benefits

In a paper given before this group in 1981, V. Hampel[13] addressed most of the economic advantages accruing from the use of an SND or SNDS. For the sake of completeness it is useful to reiterate a few of them here.

The direct savings in time of the scientist, engineer or information specialist are clear. Consider some examples:

1) the time and money expended in needlessly measuring some property of a substance which is already known
2) the effort involved in finding data of interest
3) the labour involved in re-formatting such data for further use or manipulation, not to mention the exposure to errors involved in keyboarding from hardcopy to magnetic form.

Other factors less easy to quantify but nonetheless of considerable value are the timeliness of the data (both new and corrected) and the assurance that the data are generally more reliable than those available in the open literature or in compilations.

In summary, SNDS can maximize the proportion of time spent by the scientist or engineer in creative activities and, in fact, may serve as powerful tools in those activities.

IV Recent Developments

An exhaustive review being beyond the scope of this paper, this section attempts only to scan some of the relevant advances in telecommunications and database development in order to give an indication of the state-of-the-art of these information delivery systems.

A. Telecommunications

The perfection and proliferation of public, low cost, packet-switched networks (eg. TYMNET, TELENET, GE GEISCO in the U.S.A.; UKPSS in the UK; EURONET-DIANE in Europe; DATAPAC in Canada) has made feasible the accessing of SNDS by at least two distinct schemes: centralized or "star" (host computer at one node of the network, users may access from any other node); gateway (several hosts at various nodes but a gateway computer selects and interfaces with the desired host on behalf of the user). The speed and integrity of these networks in general is such that continental boundaries are becoming transparent -- the computer on another continent often responds just as well as the one next door.

Typical examples of centralized networks are the Chemical Information System (CIS)[14] in the U.S.A., the DARC Pluridata System (DPDS)[15] in France, the Information System Karlsrube (INKA)[16] in the Federal Republic of Germany and Scientific Numeric Databases Services (CAN/SND)[5] in Canada. Common to these services is the goal of "one-stop shopping" where users can anticipate having all their database needs met simply by moving from database to database within one host computer.

A practical example of a gateway network is the Intelligent Gateway Network (iNet) trial underway in Canada[17]. On the basis of a personal profile maintained in the gateway computer, users may access a wide variety of hosts simply by entering the name or mnemonic for the desired host. All the user need do is remember one telephone number, one account code and one password; the gateway computer makes the necessary telephone connections and supplies the protocols applicable to the selected host. One of the conclusions of the Materials Data Workshop[18] held in November, 1982 in Tennessee, U.S.A. was that an intelligent gateway should be used to make the various hosts and databases comprising the proposed material properties data system easily and widely available. Ideally, the gateway computer could automatically select the database appropriate to the user's query as well as execute the basic connecting functions just described.

B. Databases

A fairly recent inventory of SND in the physical-chemical disciplines has been compiled by Hilsenrath[19]. The categories employed in that publication serve as a useful framework for listing some of the databases released or nearing release since the compilation was completed.

1. Identification of Unknown Substances

In the area of infrared spectra, a new component of CIS[14] called Infrared Search System (IRSS) features fully digitized spectra, with the potential option of graphical reproduction at the user's terminal, rather than the so-called "fingerprint" representations used in the systems mentioned earlier[3-6]. The trade-off to be considered, of course, is the much smaller number of spectra (approximately 3000-5000) currently available in IRSS.

Two new crystallographic databases will soon be available. The Inorganic Crystal Structure Database (ICSD)[16, 28] and the Metal Data File (MDF)[5,25], which have bibliographic and structural data on the substances suggested by their names, are complementary to the Cambridge Crystallographic Database of organic and organometallics mentioned earlier.

2. Properties of Pure Substances and Mixtures

The database being compiled as part of the program of the Design Institute for Physical Property Research (DIPPR)[20,21] will contain thermodynamic and physical property data of industrially important compounds. Current information indicates that members of DIPPR will have priority access to both hardcopy and magnetic forms. Public release of the first 200 compounds is anticipated in 1984.

Data on thermophysical, thermoradiative, electronic, electrical, dielectric, optical and magnetic properties of all materials of scientific and technical interest are being assembled into a Material Properties Numerical Data System[22] by the Center for Information and Numerical Data Analysis and Synthesis (CINDAS) at Purdue University. Plans call for it to be online and interactive but no release date has been announced.

THERMO, the NBS Chemical Thermodynamic Database which has recently been released on the CIS[14], contains the recommended values for selected thermodynamic properties of about 15,000 inorganic and simple organic (one- and two-carbon atoms) substances. This is an excellent example of a SND in which the evaluation function has been strongly emphasized.

3) Properties of Materials

Source databases dealing with properties of materials of engineering interest, especially mechanical properties, have tended to remain small in size and limited in accessibility. A recent review by Westbrook[21], for example, reported that over 40 such databases have been identified, none of which was publicly available. One major impediment is that the properties of engineering materials are more complex to quantify than those of pure substances; universally accepted standard test methods, materials

properties definitions and appraisal procedures are still pending. These and other problems were discussed at the Materials Data Workshop[18] mentioned earlier. As an indication that some progress is being made, however, three databases dealing with steel and plastics were announced there as being publicly available; a fourth database, on metals properties, has been recently announced.

Measured Properties of Steel[23] contains mechanical properties, long term creep rupture data, fatigue behaviour, deformation properties and physical characteristics on some 300 grades of steel. References to the relevant literature are also stored. Standard Properties of Steel[23] contains standard values of the chemical composition as well as the mechanical, technological and physical characteristics of approximately 1000 grades of steel.

A textual-numeric database system with property or attribute data but limited analysis capability, POLYPROBE[24] contains information about various characteristics of commercially available plastics. POLYPROBE is meant to be used chiefly as an expedient means of locating suitable materials rather than as a research tool in predicting performance or response.

Metals Datafile/I[25] contains mechanical and physical properties data like tensile strength, yield point, shear and impact strength, hardness, fatigue life, density, specific heat, melting temperature and conductivity as well as composition, specification and designation information. Bibliographic references may also be retrieved. Like POLYPROBE, this database appears to be primarily a means of locating, rather than studying, the material of interest.

V Survey of Activity in Canada

Through the CAN/SND office of the Canada Institute for Scientific and Technical Information, the National Research Council (NRC) encourages and supports SND use and development in Canada. A national online network has been established, several SND are nearing completion and some interesting database management system applications are being developed.

As mentioned in the previous section, the DATAPAC network of the TransCanada Telephone System permits anyone in Canada with a terminal and a telecommunication link to access the SND mounted on the NRC computer in Ottawa. The current access cost of (Cdn) $10.50 per hour is the same for virtually all users because network charges are distance independent and there are sufficient network nodes that most users need only make local (ie. time independent) telephone calls. With added charges for computation, typical costs are (Cdn) $30-$90 per connect hour. Publicly available since November 1981, the CAN/SND online service currently has 37 institutiona' accounts. Users may interact with the database of their choice in either English or French. Two databases, infrared spectra (SPIR) and the Cambridge Crystallographic Database[2] (CRYSTOR), are available at the time of writing. Others planned for the near future include the MDF and ICSD mentioned earlier as well as the Crystal Data Identification File[26], the Powder Diffraction File[26] and the Facility for Analysis of Chemical Thermodynamics (FACT)[7].

The MDF, which contains crystallographic and bibliographic data for metallic structures determined by diffraction methods, is being developed in the Chemistry Division of the National Research Council[27]. When completed, the file will contain about 5600 entries for structures determined from 1913 to the present. An additional 4000 entries, covering 1975 to the present, describe those metals and alloys for which sufficient data are available to assign them to known structure groups. Another 800-1000 entries will be added annually as updates. Initial plans call for the National Research Council to make the MDF available online in Canada and by magnetic tape lease worldwide except in the Federal Republic of Germany where the Fachinformationszentrum Energie, Physik, Mathematik[16] (FIZ) will be responsible.

The ICSD, containing the same types of data as the MDF but for inorganic compounds, is being developed through German-Canadian co-operation[28]. The University of Bonn produces the major part of the file with support from the FIZ. McMaster University, under sponsorship of the National Research Council, produces most of the remainder. With 17,000 entries at present, the ICSD is about 80% complete. Another 1200 entries are anticipated each year as updates. FIZ will be making the ICSD available online from Karlsruhe or by magnetic tape lease in all parts of the world except Canada where the National Research Council will be responsible.

To complement ongoing database efforts, work is also proceeding on the development of search, retrieval and analysis software. The National Research Council Information System (NIS)[29] has been adapted for interactive use of the Crystal Data Identification File[30] as well as the MDF and ICSD. In prototype is an application of NIS to the connectivity files of the Cambridge Crystallographic Database. Preliminary results indicate a saving in execution time by factors of 10-20 over times required by the connectivity searching program (CONNSER) supplied by the Cambridge Crystallographic Data Centre.

VI Conclusion

Given their capabilities and benefits, scientific numeric databases are cost-effective research tools for scientists and engineers. Developments in telecommunications and increases in the number and types of databases available, not to mention the impact of personal computers, are all combining to make these tools readily accessible on a worldwide scale.

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GRAPHIC AND VISUAL PRESENTATION OF AEROSPACE DATA

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SUMMARY

The efficiency of computer-based information retrieval systems can be substantially improved by presenting the information subject on a television monitor not only in alphanumeric but also in pictorial form. For systematic retrieval of specific information, a large information base for alphanumeric and pictorial data must be carefully structured. Special technical equipment for storing and presenting the information must be available, especially when a large number of users will have access to the information base simultaneously.

1. INTRODUCTION

It is well known that information can be stored in computers. For that purpose the information has to be suitably encoded. The encoded data however is no longer directly presentable to the user, neither is it possible to read the information directly. To retrieve a specific information the computer must be addressed in a special language which is different from the spoken language. Therefore, in order to be understood by the computer, the request has to be translated into computer language. The computer will then retrieve the information and process the data for the presentation to the user.

The information to be stored need not only be in alphanumeric form, it can also be in pictorial, e.g., still or moving pictures, or even in acoustical form. Pictorial and acoustical information is not normally stored in computers. Such information is stored in special devices which are controlled by computers.

Such information systems are only meaningful and economical if the amount of information is large and if many people will have access to the information pool.

Sophisticated data base strategies must therefore be applied and handled by computers for a large number of users. This paper focuses on the structuring of the information, the retrieval strategies and the variety of presentation. Finally, a structure of the underlying technical system will be described.

2. STRUCTURING OF INFORMATION

The basis for establishing an information base, e.g., a library, is the existance of a large number of documents e.g. in this case books and journals. In the simplest way, every item will be assigned a number and this number will be contained in a catalogue. If there is a large number of items, it is nearly impossible to find a specific book because in every case the user must look through the whole catalogue first to find it. Therefore the librarian will divide the information in a similar way as in large libraries.

There are two types of structuring, one for the expert and another one for the non-expert user. If the structure is prepared for the latter case of users the person who wants a specific book, can manage it without the help of the librarian.

All these procedures must be installed in a computer if we want to offer a computer information system to an inexperienced user.

The easiest way to structure the information base is by introducing a hierarchy. There is a main table of indexes followed by many others containing subindexes. This strategy results in a so-called tree-structure of the information. All information about the structure of the information base is contained in the index tables.

There are some shortcomings in that strategy. If the user enters the wrong tree of information he will never find the correct document despite its availability. The other shortcoming is that the same document can be of interest in many trees of the hierarchical structure of information. In that case the document must be stored many times.

To avoid these shortcomings a different strategy will be applied. If one identifies a document only by its relation to other objects, then the relational model can be applied.

In consequence information must not only be stored in the data base as factual data (these data bases consist of indivisible documents and are called the "unstructured knowledge"), but there is a need to store the so-called structured knowledge also.

The following parts of knowledge in addition to the factual knowledge must be installed in the users input analysis. /1/

The database for an interactive service can be organized into seven major areas:

- unstructured knowledge
- structured knowledge
- lexical knowledge (semantic)
- language knowledge (syntactic)
- user profile knowledge
- dialogue history
- error handling.

The bulk of the database consists of a collection of information units (pages), which constiture the unstructured knowledge. A page can be a video segment, audio segment, one or more video stills, some alphanumeric text, or any combination of these. Each page is considered an indivisible element and is meant to be displayed in its entirety. Another part of the database is the structured knowledge, analogous to the index of book which stores the hierarchical and semantic interrelationships between the pages.

3. USER ACCESS TO INFORMATION

Independent of the organization of the collected data - in numerical order, hierarchical order (tree-structured) or relational order - one also has to think about user access to the information.

If a user requests an information about a specific item - and if there is no technical system holding the information - he asks one person about the wanted information; he does it with his own words and on the background of his own knowledge of the area of information. The person who has the information must translate the inquiry into the structure of an experts' knowledge, but he must keep in mind how detailed the information must be given and how the information should be presented.

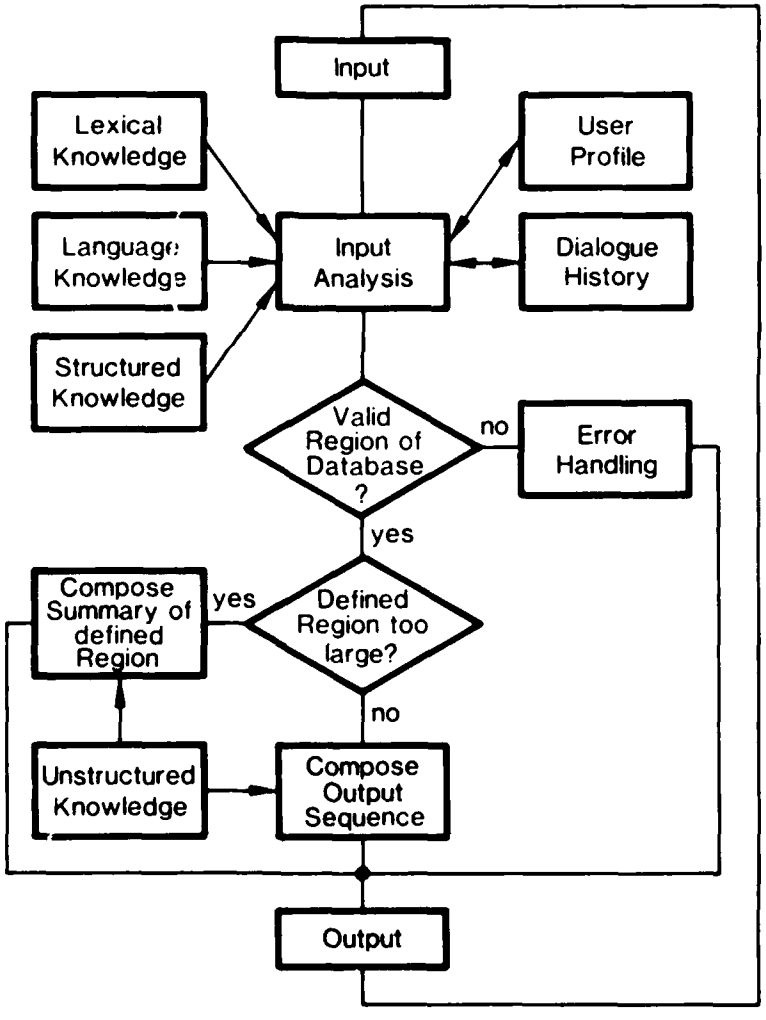


Figure 1

Interaction for answering a uses question and used areas of knowledge

All these steps must also be carried out with a computer based data system. If there is only the factual data (unstructured knowledge) available, all above-mentioned processes must be carried out by the user. This often leads to the ridiculous fact that the user only finds the information if he knows where the information is stored. That is the contrary of what we want. The user must get assistance to find the correct answer without knowing the structure of area of knowledge and without knowing co...puters software.

A powerful man/machine interface must therefore be designed which guides the user through the data base to find the correct answer without the necessity of looking up information he is not interested in (information overflow).

In a typical interaction, depicted in Fig. 1, the user enters words which attempt to define a subject about which he/she wants information. The system responds by analyzing the input in the following stages.

1) Input words are matched to stored dictionary words.

The latter are of two types: lexical (words which refer to objects, properties, relationships, facts, events, procedures, etc., and which are keyed to the pages) and standard language (prepositions, articles, modifiers and specifiers).

2) Word groups are matched to a phrase dictionary.

Failure of 1) or 2) results in an error message to rephrase all or part of the input. Success of 2), through the use of the structured knowledge, results in the definition of a unique region (collection of pages) of the unstructured database.

If the defined region of the database is manageably small, an appropriate sequence of pages is composed, accessed, and displayed. If it is not, a menu-like summary of the defined region is composed and displayed. An interactive process thus ensues, in which the defined region is finally reduced to a manageable size. As previously described, this process can be modified at any time with special command keys or aborted and new input entered.

The input analysis and output composition processes are, in general, modified by the dialogue history (e.g., to resolve context ambiguities and prevent repetitious mistakes) and user profile knowledge (e.g., is the user a novice or expert? what is his/her native language? etc.).

4. VARIETY OF DATA PRESENTATION

In the past, presentation forms followed the technical development in the telecommunications technology. First came the telephone, than the telex, than the audio broadcasting and so on. Before the technical state of the art will be considered, the demands for information systems from the didactical standpoint should be considered first.

To give an information to someone implies that the person after getting the information is familiar with the underlying facts. This can only be attained if the information will be given in the original form, i.e. one must hear Beethoven's Symphony or one must see the nebula; a description will only give an incomplete idea of the facts.

Following this, an information system must be able to present the data in non-textual form, if a textual description proves to be insufficient. Therefore following presentation forms must be available either exclusively or mixed in random access

- text
- graphic
- still picture
- moving picture
- speech
- sound signals

which then can be used in an interactive dialogue with the information system.

5. TERMINALS AND STORAGE DEVICES

To present all these information forms to the user, a terminal consisting of a visual display and a pair of loudspeakers is necessary. Since coloured moving pictures should be shown, a colour TV monitor would be the adequate terminal. The alphanumeric characters to be displayed should be large enough. There must be a compromise between character display and the reproduction of moving picutures. The recommendation for viewing conditions for TV is that the distance from the monitor should be a minimum of four times picture neight to avoid the visibility of interline and interfield flicker. To display characters and graphics on a TV monitor, a field memory must be installed in the terminal because signals for this presentation form are fed to the terminal in off-line form and must first be processed to be displayed on a conventional TV monitor. For that purpose a decoder (NTSC, SECAM, PAL) with component output signals is required. The output signals are then routed through a mixer to the RBG monitor. The block diagram of the terminal is shown in figure 2.

For addressing the information computer - in addition to the other equipment - a microprocessor-controlled keyboard must be installed.

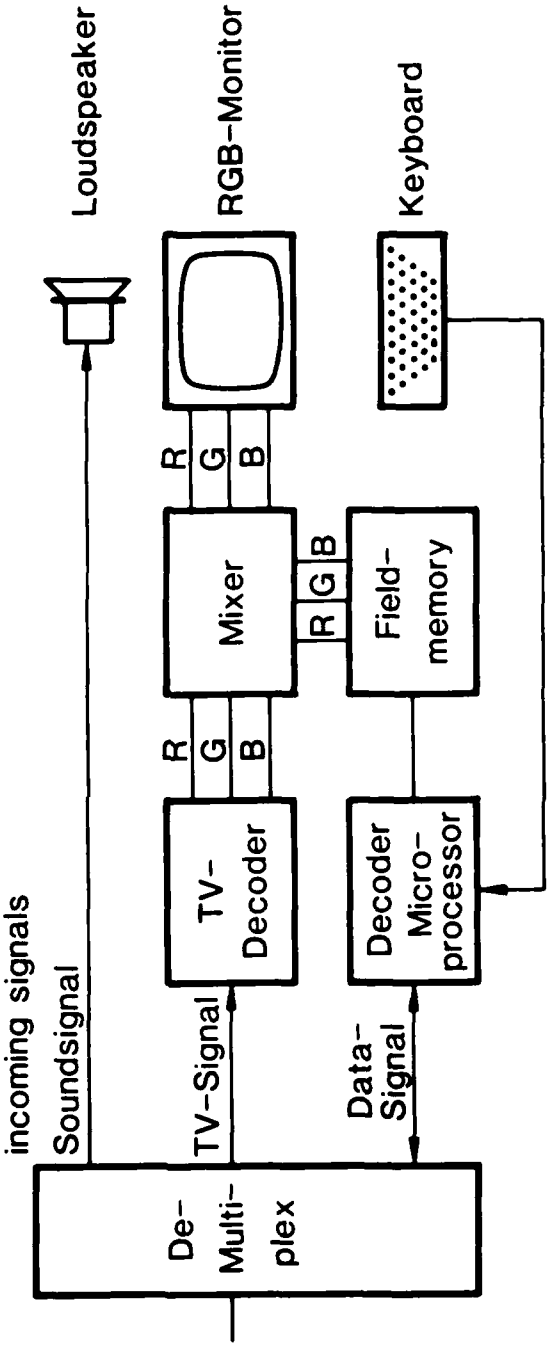


Figure 2

User's Terminal interactive multimedial information system

As far as the size of the field memory is concerned there are different levels depending on the technical standard which are listed in the following table.

Levels of character/graphic generation	Memory field size
alphamosaic (Teletext)	1 KByte
(Teletext extended standard)	2 KByte
alphageometric (Telidon)	50 - 500 KByte
alphaphotographic (addressing of each picture element)	600 KByte

Table I: Size of the memory for different levels of generating symbols

In the first case only small segments of the total pictures are addressable (mosaic), in the last case each picture element can be modified seperately.

6. STORAGE DEVICES

For the different presentation forms the signal must be stored on devices which allow random access, because in a flexible information dialogue it cannot be forseen in what sequence the different documents are wanted.

In the next table the storage capacity and the transmission rates are listed:

Presentation form	storage capacity	transmission rate	storage device for random access
Text (one page)	1 KByte	1,2 - 9,6 Kbit/s	Magnetic disc
graphic (one page)	2 - 10 KByte	9,6 - 48 Kbit/s	
still picture	0,5 MByte	1 Mbit/s	
moving picture sequences		140 Mbit/s	Video disc
stereo sound		1 Mbit/s	magnetic or video disc

Table II: Storage and transmission demands for the different presentation forms

As pointed out earlier a technical system is only economical if many services are available for a large number of subscribers. Therefore it is necessary to calculate the total storage demand for the different presentation forms and for the algorithms necessary for that purpose. For example, there was a multimedial information service for vocational guidance /2/. In the Table III the parts of the content and the storage requirement and size of workspace are listed.

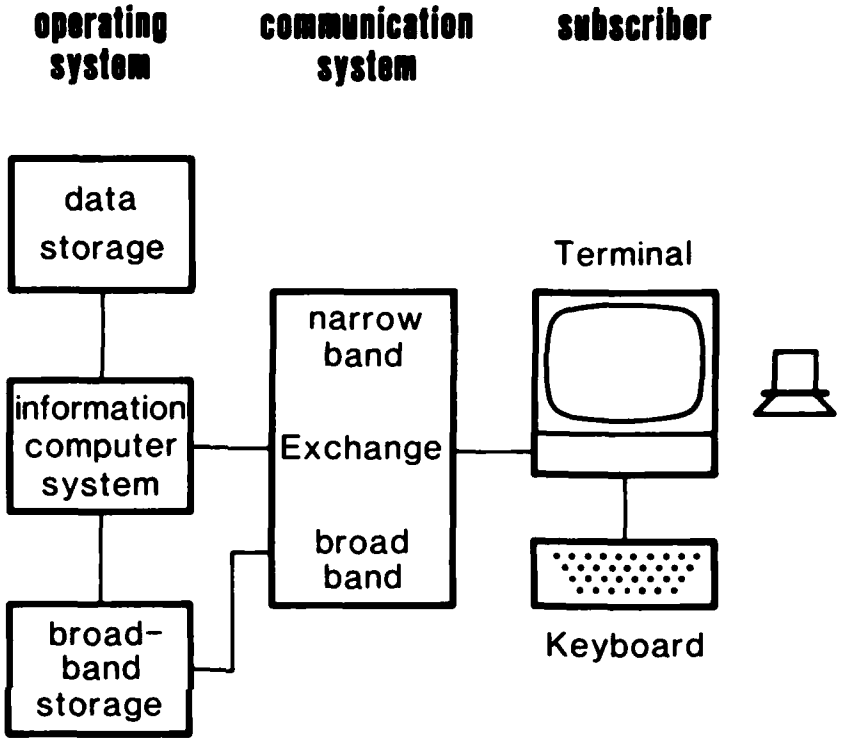
Parts of the contents of a multimedial information system	Storage requirement
1800 text pages with canned and generated frames	3 MByte
1000 still pictures	6 double side video disc
5 h film sequences	
10 min. acoustical sequences	
algorithm	1 MByte

Table III: Amount of information to be handled by an operating system described below

7. ENTIRE TECHNICAL SYSTEM

To connect the users terminal to the information computer a narrow band and a broad band transmission system must be available. The computer has a mass storage device for algorithm and data and handles the storage devices for broad band information (video disc).

Figure 3 shows a simplified block diagram of the technical system.



Blockdiagram of technical system

Figure 3

Not shown and not discussed are the problems and the technical equipment for creating and modifying service.

CONCLUSION

To establish a multimedial information system the technical components are available today. Such systems are helpful and economic only, if a large number of subscribers have access to the information system. To establish a userfriendly information system requires not only the technical equipment to be readily available, but any effort has to be undertaken to prepare the information in suitable presentation forms and to structure the area of knowledge to allow a fast straight forward information retrieval of the user.

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THE STANDARDIZATION OF BIBLIOGRAPHIC DATA

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SUMMARY

The development of large machine-readable bibliographic data bases, functioning a.o. as union catalogues, is a remarkable step forward in the evolution of the library and information world. Library networks, like all co-operative projects, only efficiently function if the composing parts are constructed according generally accepted norms.
In this paper, the different aspects of the standardization of bibliographic data are discussed. First the bibliographic contents part is handled. Cataloguing rules, the Paris Principles, the ISBD, filing rules and also subject indexing are looked at. Subsequently the more computer-oriented aspects are treated, namely the content designation and the physical format structure. These concern the MARC II format, UNIMARC, the UNISIST reference manual and the CCF. As well the progress made in the library community as in the documentation world is surveyed. Finally a practical application of the standards is presented through the description of NEWWAVE, which is the on-line cataloguing and information retrieval system developed and used at the Royal Library in Brussels.
It is concluded that much important work has been realized in the field of the standardization of bibliographic data, but also that some problems are left for the future.

1. INTRODUCTION

An important step in the information retrieval process is the localization of the library or of the documentation centre where the publication needed is available. The evolving of important automated union catalogues, ranging from centralized library networks to computer to computer communication systems, contribute in an efficient way to achieve this task. The nucleus, around which everything turns, in these shared projects is the bibliographic information.
The joint development and exploitation of common data is only possible if standardized working methods are adhered. Normalization procedures have its imperatives on all levels of the systems. In this paper the standardization of the bibliographic data is discussed. Before tackling this problem a brief historical overview of the origin of the union catalogue data bases will be given.
The initial attempts of sharing machine-readable catalographic material date from the middle of the sixties. Indeed, in 1965 the Library of Congress started the design of a format for a standardized machine-readable catalog card. As will be seen later this project laid the foundations of most subsequent normalization efforts. In that time the computer technical people already recognized the benefits of the common use of bibliographic material in large automated systems. The library managers however took a more reserved attitude. The selfcontained politics was a burden on the development of many cooperative projects. Fortunately this situation did not bloc the progress of the necessary standardization work. Now, nearly twenty years later, the fear for automation has been removed, the benefits of computerized collaboration are better understood and also economic factors influence the library management directives. Collection sharing and information exchange became an urgent need. More and more cooperation programs are initiated, and it has to be expected that external relations will greatly influence the future of the library community.
Being convinced of the need of the standardization of bibliographic data, the origin and the development of the norms will be discussed in the first part of this paper. The standardization of machine readable data has many aspects. There is the normalization of the contents of the bibliographic information and also of the format under which the data have to be exchanged in machine-readable form. The first problem has to do with cataloguing and with subject indexing systems. The second concerns the codification of the bibliographic information, namely the content designation, and also the physical structure of the records. These different subjects will be treated separately in the following points. While discussing the content designators special attention is paid to separate developments in the documentation community. The last part of the paper describes the practical application of bibliographic standards in NEWWAVE, the real-time cataloguing system of the Royal Library in Brussels.

2. THE CATALOGUING RULES

2.1. THE CATALOGUING RULES AS A WHOLE

The standardization of cataloguing rules will be discussed in subsequent sections. First the cataloguing code is looked upon as a whole. Afterwards the parts in which remarkable normalization progress has been made are highlighted.
A worldwide standard for cataloguing rules as a whole does not exist. It is also unrealistic to think that in this field acceptable results will be obtained in a near future. The reasons for this unfortunate situation are obvious although. Cataloguing has a very long tradition and in the past each specific application had its own rules. Also the geographic location where a code is practiced and the language of the catalogue are important factors leading to diversification. So a great variety of rules are in use

and it is well known that long lasting habits cannot be changed easily.
On a smaller scale however normalized codes have been developed. A significant example for this are the AACR (1) (Anglo American Cataloguing Rules), first published in 1967 and prepared by leading organizations in the United States of America, Great Britain and Canada. The code is extensively used in the English speaking countries. The second edition of the AACR, published in 1978 takes into account internationally accepted standards as the Paris Principles and the ISBD, which will be discussed in the following points. Due to its normalization character and also to its thoroughness the AACR were also taken as a starting point in the elaboration of national standard rules in many other countries. For instance this is the case for all the Scandinavian countries and also for Belgium.
The obstacles to the standardization of the cataloguing rules as a whole are important. However, for some well defined parts, the problems have been challenged.

2.2. THE HEADINGS

The headings being the access points to all bibliographic information, are an important part of the cataloguing rules. It is not surprising thus that the choice and the form of the headings, were the subject of the first significant international standardization attempts. In 1961, in IFLA (International Federation of Library Associations and Institutions) an agreement on the common treatment of the headings was reached and published under the name of the "Paris Principles" (2). We will limit ourselves here to comment on two important agreements. The first one illustrating the benefits of international cooperation, the second one proving the difficulties in bringing together irreconcilable realities.
The collocation principle, the interesting one, which affects in a significant way the automation of catalogues, states that all works of one author are to be found in one place in a catalogue. The same holds for all editions of one work. The collocation principle is followed in most of the library catalogues.
The other principle has to do with the choice of the entry word of personal names consisting of several words. The agreement sounds as follows : "the choice of entry word is determined so far as possible by agreed usage in the country of which the author is a citizen, or, if this is not possible, by agreed usage in the language which he generally uses". This implies that identical names, of authors with different citizenship, may be located in very distinct places in the catalogue. The repercussion of this principle on the library patrons searching in the catalogues needs no comments. Of course this rule does not excite much enthousiasm in the library community. The AACR for instance do not follow it.
For the moment being another group in IFLA, works on normalized codes for handling corporate bodies. Among others an international numbering system for authorities is under development.
The controversy over certain of the Paris Principles proves that indeed, normalization work in the field of cataloguing codes is not a senecure.

2.3. THE DESCRIPTIVE PART

It was only ten years after the statement of the Paris Principles, that important progress has been made in the standardization of other parts of the cataloguing rules, namely the bibliographic description.
The first ISBD (International Standard Bibliographic Description) (3) also developed by IFLA, was published in 1974. The purpose of the ISBD rules, as stated in the publication, is threefold, namely :

"making records from different sources interchangeable ;
assisting in the interpretation of records across language barriers and
assisting in the conversion of bibliographic records to machine-readable form".

To achieve this aim, the descriptive bibliographic data are divided in well ordered areas and subareas, separated by a standardized punctuation scheme. There has been a lot of dispute on the choice of this punctuation. Its complexity and the non-fulfilment of the last objective give rise to a lot of discussions. Indeed, the possiblility of automatic computer manipulation of the bibliographic data has to be excluded, since the same punctuation is used with different meanings at distinct places. Also the rigid ISBD-punctuation is a burden when producing non-ISBD output data.
However it has to be noted that the standardized way of presenting the bibliographic descriptions is experienced as a big step forward in the process of interlibrary collaboration. One has to recognise that the ISBD became an important communication language in the library community all over the world. The general acceptance of the ISBD is illustrated by the fact that all new cataloguing rules are ISBD based. Also revision processes of existing rules take into account this new standard. Another vivid example of the success of the ISBD is the growing importance of the CIP (Cataloguing in Publication) program. Many publishers, in collaboration with the national bibliographic agencies, print a preliminar ISBD on the verso of the title page of their works published. Thus libraries acquiring such publications, get at the same time most of its cataloguing information in the familiar ISBD form.
Finally, and not least, the more standardized way of representing bibliographic data makes its interpretation by the library patrons and the information users more easy.
Notwithstanding its shortcomings the ISBD is an important contribution in the process of the normalization of cataloguing rules.

2.4. FILING RULES

While IFLA is working on the standardization of the headings and of the descriptive data, the ISO (International Standard Organization) is concerned with the normalization of filing rules.
Also in this field insurmountable obstacles are encountered. Because of the fundamental differences in the existing filing rules, the ISO working group could only reach agreement on very general principles.
Apart from the international normalization efforts, it is interesting to note the evolution of the filing rules in automated catalogues. In these systems there is a general tendency to move away from classified or grouped arrangements towards more strictly alphabetical sorts.
These simplified filing rules are warmly accepted by the users, who are not always aware of the complex structers built in the manual systems.

3. THE SUBJECT INDEXING SYSTEMS

3.1. SYSTEMATIC CLASSIFICATION SYSTEMS

The treatment of the subject indexing problem is split into two parts. First the well established systematic classification systems are briefly commented. Afterwards the international evolution in the field of the alphabetical subject headings is outlined.
In discussing the normalization of systematic classification schemes, two internationally accepted systems have to be considered namely the Dewey classification (4) and the UDC (Universal decimal classification) (5). The Dewey classification originated already at the end of last century in the USA. This indexing system is mostly used in the English speaking countries. The UDC, on the other hand, is based on Dewey and developed in Belgium in the beginning of this century. The UDC is more internationally oriented and has most of its adherents in Western Europe.
I do not intend to enlarge on these old generally accepted indexing standards. It is just interesting to note that these first international norms concern language independent data.
Another point on which I want to draw the attention is the fact that in on-line retrieval systems, the systematic classification schemes lose of their importance in the advantage of alphabetical subjects. Indeed, compared with manual systems, on-line searching on numeric data does not give new benefits as is the case with alphabetical data. The use of single words, truncation techniques and Boolean combinations, provide the on-line alphabetical subject access with a number of new perspectives.

3.2. ALPHABETICAL SUBJECT HEADINGS

For the alphabetical subject headings no real international standards do exist. In this field the language barriers are the most important obstacles to international cooperation. One system although, namely the LCSH (Library of Congress subject headings) (6) gradually gets more followers. The system is used in many English speaking countries, in South America, in France and also in Belgium. A French translation has been made in Canada at the University of Laval. In France and in Belgium the national libraries use this translation in the development of two other versions. In my country, additionally the Dutch language terms are added. Finally a number of South American countries made a translation into Spanish. Note that all these translations concern separate versions. Identity can only be obtained partly and this for many reasons. So, for instance, each language has its own particularities, a one to one translation is not always possible, or grammar may be different. Another aspect which leads to deviations is the degree of specificity necessary in certain domains, as for example history. It is obvious that in this field the needs of a North American library significantly diverge from these of a library in another country.
The future will have to point out if the LCSH will get more success. Anyway the system is becoming a standard in the on-line data bases within the USA (7). It is also worthwhile to mention that the CIP program, which is most spread in North America, contributes in a considerable way to the international propagation of the LCSH.
As the process of the transborder information exchange continues to expand, the necessity for an internationally accepted alphabetical subject headings system will be felt more and more.

4. CONTENT DESIGNATION

4.1. MARC (Machine-readable cataloguing) II

The more computer oriented aspects of the bibliographic standards concern the format definition. Two distinct problems have to be considered : the content designation and the physical structure. The content designation part, being related very closely to the contents of the bibliographic data will be handled first.
In UNIMARC (Universal MARC format) (8), which is discussed in the following point, a content designator is defined as quoted here : "the means of identifying data elements and/or providing additional information about a data element. Content designators consist of tags, indicators and subfield identifiers".
The historical evolution of the standardization work in the field of content designation is chronologically related. First comes the MARC II (9) format, then UNIMARC (8) and in parallel the UNISIST (United Nations information system in science and technology) (10) format, which has been developed especially for the abstracting and indexing services, and finally the CCF (Common communications format) (11), bridging the objectives of the library world at one hand and of the documentation world at the other hand.
The content designation problem appeared in the early sixties with the development of the first computerized bibliographic files. The Deutsche Bibliothek put the first significant steps into this direction for the automation of its Bibliography. However, the Library of Congress made a more thoroughly analysis of the distinct bibliographic elements and thus led the foundations for all future standardization work. In 1968 the well known MARC II (9) format was published. At that time also many large libraries all over the world seriously started considering automation. From the beginning most systems designers being aware of the new possibilities of exchange of information, recognized the importance of content designation standardization. Due to its soundness the MARC II format was taken by most as a starting point. In the subsequent adaptation processes two distinct tendencies can be distinguished, namely those emerging from American libraries and those coming from other countries.
The American libraries, while appreciating the general applicability of the codification scheme, criticised the specificity of certain items. Thus while defining an own content designation set each organization dropped the details judged as being superfluous. Of course the downgrading differed from system to system.
In the other countries just the reverse situation happened. Marc II being based on the AACR, each library needed to augment the format with the particularities of its own cataloguing code. This evolution resulted in an uncontrolled explosion of MARC-"compatible" formats. To name only two members of this family : BNB (British National Bibliography)-MARC was one of the first followers; INTERMARC emerged from the collaboration of a number of West European national agencies. In this last format the modifications added concern some fundamental aspects, namely the processing of multilingual bibliographic material in

in a multilingual environment and the treatment of multilevel hierarchical publications.
So far the historical aspects of MARC II. What about the actual situation ? In the USA the library networks abandoned their local format limitations and found a common communication language in the full MARC II content designators set. In the other countries however the situation remains still confused. No consensus on the use of a unique exchange format has yet been reached. The most commonly applied communication tools are MARC II and BNB-MARC. A new development nl. the UNIMARC (8) may bring a solution on a longer term.

4.2. UNIMARC

Due to the prosperous proliferation of the MARC family, IFLA recognized already in the beginning of the seventies, the need of the establishment of an international standard on content designators. The "Universal MARC format" (UNIMARC) (8) was born in 1977. However, for the moment being, six years later, only very limited use has been made of this new instrument. Let us try to determine the reasons behind. First of all, as can be concluded from the previous point, the English speaking countries, which concentrate most of the bibliographic exchange traffic, are self-supporting. Also the leading libraries in these countries, which usually start the application and the promotion of new international standards, because of the economic crises, did not take any initiaves yet. On the other hand, in the other countries cooperation between different automated systems is less developed. Also the UNIMARC format, although developed by an international working group, only in a minor way reflects the needs of these last countries.
Compared with MARC II, UNIMARC has completely rearranged the sequence of the bibliographic data. The MARC II tagging scheme is based on the design of a catalogue card. In UNIMARC on the contrary, the information is grouped in functional blocs, namely the :

identification bloc (ISBN...);
coded information bloc (fixed field data);
descriptive bloc (ISBD);
notes bloc (free text statements);
linking entry bloc (linking related records);
related title bloc (access point titles);
subject analysis bloc (UDC, Library of Congress subject headings...) and
intellectual responsability bloc (authors...).

In view of the enormous processing possibilities of machine-readable records this rearrangement of the bibliographic information sounds more logical. Note that the descriptive bloc is based on the ISBD, which did not exist at the time MARC II was developed. Also the linking entry bloc, although not worked out in a sensible way, forms an important progress.
If the grouping of the bibliographic information in UNIMARC results from a new concept, on the contrary the definition of the fields, subfields and indicators remains completely MARC II based.
In order to get a complete overview of the bibliographic standardization work it is necessary to also consider the results elaborated by the documentation centres.

4.3. THE UNISIST REFERENCE MANUAL AND THE CCF

Up to now, we have been concentrating on library applications. The abstracting and indexing communities have been intensionally neglected because their bibliographic needs, although similar, impose less restricting requierements. Norms for libraries can, eventually in simplified form, as well be adopted in documentary applications. The reverse however is not valid.
Bibliographic standardization projects, in the abstracting and indexing world, started in parallel with the UNIMARC development. The UNISIST reference manual (10) sponsored by UNESCO, was first published in 1974. This work procures, next to MARC II based content designators also cataloguing rules.
Compared with the previously discussed norms, the UNISIST prescriptions are limited to documentary applications and thus are simpler in concept.
It is interesting to note that the UNISIST reference manual is used in several organizations, however mostly as a cataloguing code. Indeed there was an urgent need of normalized cataloguing rules for treating documentary information.
In 1978 the existence of two different standards for machine-readable bibliographic descriptions : UNIMARC and UNISIST was ascertained. The libraries and the other information services met for discussing this problem. As a conclusion it was decided that none of both formats could be abandoned in the advantage of the other, the objectives being too disparate. A new communication format, the CCF (Common communication format) (11), bridging the divergencies of the existing norms had to be developed. The birth of this new MARC member is foreseen for the end of the year.

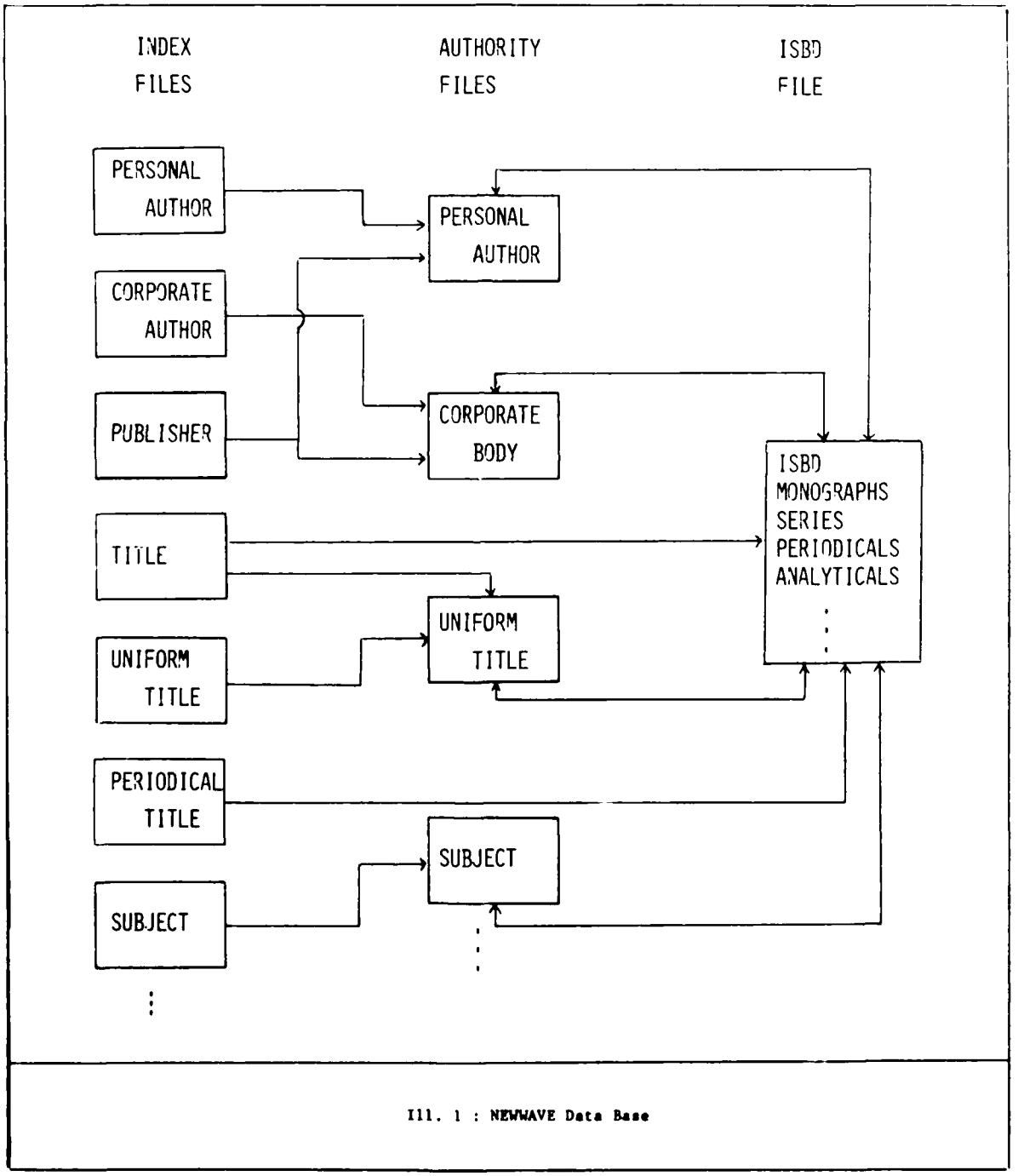
5. THE PHYSICAL STRUCTURE OF THE RECORD

The last standardization problem we have to deal with, namely the physical structure of the record is the one which induced the less controversy.
As well known, each automated system, according to its own particular hard- and software requirements, processes the bibliographic data in a specific internal format. For exchange purposes however a standard physical structure, acceptable by all types of hard- and software, is necessary. In this field again, the Library of Congress effectuated the pioneering work. The MARC II format established both, the content designators and an exchange structure. The American National Standards Institute upgraded this format in 1971 into a national norm. This formed on its turn the basis of the international ISO standard, ISO 2709 : documentation format for bibliographic information exchange on magnetic tape (12), which was first published in 1973.
For obvious reasons this bibliographic standard was spared of all the difficulties the other standards went through. On the one hand we have to do here with a pure computer technical matter, no content problems intervene. At the other hand, MARC II was the only existing exchange format.
Also the report on the use made of the ISO 2709 is very positive. As well the library as the documentation communities adhere this standard.

6. NEWWAVE : THE ON-LINE CATALOGUING SYSTEM OF THE ROYAL LIBRARY IN BRUSSELS

6.1. GENERAL INFORMATION

The development of NEWWAVE was started at the end of the seventies. The final aim is the realization of an interactive real-time integrated system with network facilities. Since the beginning of '81 the cataloguing part combined with extended retrieval possibilities is operational.
One of the interesting features of NEWWAVE is that it takes into account most of the bibliographic standards. It is indeed a grateful practical example for the demonstration of how normalization prescriptions can be implemented in an operational environment.
In discussing the standardization aspects of NEWWAVE we will start with the computer technical norms, the more bibliographic aspects are treated afterwards.
To give an idea of the concept of NEWWAVE ill. 1 gives the logical design of the data base. Three types of files are provided : the ISBD file, the authority files and the index files. A file for local data will be added shortly. This will enhance the system to a full shared cataloguing tool. One of the special characteristics of NEWWAVE is that it provides special technics for linking records. Of course the authority data are linked with the ISBD records. But is is also possible to link records within the same file (a.o. linking a monograph to its series, linking records of multilevel monographs, etc.).



Ill. 1 : NEWWAVE Data Base

6.2. THE PHYSICAL STRUCTURE OF THE FORMAT

The internal format of the NEWWAVE data base is ISO 2709 compatible. Fields, subfield and indicators are used.
Up to now, neither external data are added to the NEWWAVE data base, nor information is distributed for external use. However plans do exist for augmenting the bibliographic information with Library of Congress data and also with Dutch Royal Library data. For this purpose conversion programs from and into the MARC II format have to be written. No technical problems are expected in this work.
The latest development of NEWWAVE is the implementation of a commercial DBMS (data base management system), namely SESAM, a product of our hardware constructor SIEMENS. SESAM is a DBMS of the relational type capable of handling variable field data. For the moment the NEWWAVE bibliographic data base is converted into SESAM's internal format. In this new format the ISO 2709 compatibility is preserved.

6.3. THE CATALOGUING RULES

6.4.1. The cataloguing rules as a whole

A uniform cataloguing code (13) has been worked out on a national level by the University libraries and the Royal Library. As a starting point most of the important standardization works, namely the Paris Principles, the ISBD and the AACR have been taken. The code is established in view of the realization of a computerized national union catalogue, so the new possibilities of automation have also been considered. As one of the consequences the authority data rules are handled separate from the descriptive information.

6.4.2. The Paris Principles

The collocation principle of the Paris Principles is met in a very efficient way by using separate auchority files for the processing of the authors information. In NEWWAVE all bibliographic data concerning an author are stored in one authority record. This record also contains a link to the ISBD file for each publication of the author. Apart from the collocation principle the use of authority files has some other advantages a.o. the bibliographic control on the authority data can be easily effectuated and the repeated input of identical data can be avoided.
In ill. 2 the screen display of a bilingual corporate body is presented. The first three lines contain fixed field data. Tag 000 contains the identification number of the record. The tags 110 give the main heading forms of the corporate body. For French language catalogues the French form is preferred, while for Dutch language catalogues the English one is chosen. The difference in use is expressed in the first indicator of the tag 110. Tags 115 contain the imprint forms and tags 800 and 801 the address. One notes that in NEWWAVE publishers information and authors information is stored in one and the same record. Tag 955 indicates the number of publications in the ISBD file linked with the authority record.
Ill. 2 demonstrates that, even in the case an author has more than one name, the collocation principle is respected.
Also the Paris Principle concerning the choice of the entry word of a personal name consisting of several words, has been implemented in an elegant way in NEWWAVE. A compound personal name is introduced once in the data base. Automatically additional entries are created on each significant part of the name. For this purpose a special algorithm has been elaborated. So for instance the author Wernher von Braun can be accessed on the name forms: von Braun, Wernher; and Braun, Wernher von.

```
SL                                S:    L:          N:28-10-82    K     -wl+
                                                    K:                  -
TYP:c   AUT:x EDIT:x    DAT:  -  NAT:II LANG:BIS     TR:         OFF:
0000 120484
110AF COMIT<E INTERNATIONAL DE M<EDECINE ET DE PHARMACIE MILITAIRE<<LI`EGE>>&&
FRE
110BN INTERNATIONAL COMMITTEE OF MILITARY MEDICINE AND PHARMACY<<LI`EGE>>&& ENG
115AF LI`EGE : COMIT<E INTERNATIONAL DE M<EDECINE ET DE PHARMACIE MILITAIRE
115BN LI`EGE : INTERNATIONAL COMMITTEE OF MILITARY MEDICINE AND PHARMACY
800A  LI`EGE (4000)
801A  RUE SAINT-LAURENT, 79
955A  00001
```

Ill. 2 : A bilingual corporate body

6.4.3. The ISBD

In NEWWAVE the ISBD is applied. Ill. 3 gives the ISBD of a periodical. We will only comment here on the contents of the tags 110 and 270. The other information is taken for granted. Tag 110 contains the link with the authority record of the editor of the publication. Note that the contents of this linked authority record is already presented in ill. 2. The ISBD record only contains the record identification number of the authority description. The name headings presented on the screen are automatically taken over from the authority record. The imprint in tag 270 is handled in the same way. As an example of the application of the ISBD punctuation the equal sign separating the bilingual data can be cited.

```
      SL                              S:  L:  N:08-11-82     K                -w1+
                                          K:14-04-83     K                -w1+
MON:T   MAT:   EXP:   IMP:   REF:  DAT1982          FAC      NAT:BL LANG:BIS
VERT:    NIV:s FIC:          SER:P PER:012                      C:      R:T
0000 157058
010A  R 2,748
022A  0035-3469
110A  [120484] COMIT<E INTERNATIONAL DE M<EDECINE ET DE PHARMACIE MILITAIRE  L
I`EGE>>&&FRE  = INTERNATIONAL COMMITTEE OF MILITARY MEDICINE AND PHARMACY  LI`
EGE>>&&ENG
245AF REVUE,INTERNATIONALE DES _SERVICES DE _SANT<E DES _ARM<EES DE _TERRE DE
MER ET DE L'_AIR
246AN INTERNATIONAL _REVIEW OF THE _ARMY, _NAVY AND _AIR _FORCE _MEDICAL _SERV
ICES
255A  TOME 55, NO 1 (1982)-
270A  [120485] PARIS : SERVICE DE PRESSE <EDITION INFORMATION
275A  1982-
290A  ILL. ; 27 CM
545A AREV. INT. SERV. SANT<E ARM<EES TERRE DE MER & AIR = INT. REV. ARMY, NAVY
& AIR FORCE MED. SERV.
548A  REVUE MENSUELLE = MONTHLY REVIEW
```

Ill. 3 : the ISBD of a periodical

In order to prove that the objectives of the libraries and of the information centres can be easily conciliated in one and the same system, we added in ill. 4 an example of a bibliographic description of an article. Tags 000, 100 and 245 are the same as for monographs and series. The tag 455 gives the link with the ISBD record of the periodical already presented in ill. 3. This field also contains the data identifying the location of the article within the periodical. Tag 660 gives the subject information. The example is part of the KBS (Key to Belgian Science) data base, which contains articles of Belgian scientific periodicals. In this project the TEST (Thesaurus of engineering and scientific terms) is used as subject indexing tool.
Note that the description of this analytical also demonstrates the capability of NEWWAVE to handle hierarchical relationships between records within the same file.

```
      AT                              S:  L:   N:22-06-82   K                -w1+
                                          K:30-03-83   K                -w1+
MON:A  MAT:    EXP:   IMP:   REF:  DAT       FAC     NAT:          LANG:FRE
VERT:    NIV:  FIC:         SER: PER:                          C:     R:
0000 145864
100A  [062280] EVRARD, EDGARD
245A, FACTEURS PSYCHOLOGIQUES DE STRESS DANS LE VOL SPATIAL CONCEPTS ACTUELS S
UR L'ADAPTATION HUMAINE AU VOL SPATIAL
455A   [157058] REVUE,INTERNATIONALE DES _SERVICES DE _SANT<E DES _ARM<EES DE _
TERRE DE _MER ET DE L'_AIR = INTERNATIONAL _REVIEW OF THE _ARMY, _NAVY AND _AIR
_FORCE _MEDICAL _SERVICES ; 54, I 51981). - P. 11-28
660A  STRESS (PSYCHOLOGY) ! SPACE FLIGHT ! AEROSPACE MEDICINE ! AVIATION MEDIC
INE ! PSYCHOLOGY
```

Ill. 4 : Bibliographic description of an article

6.4.4. Filing rules

As in most automated systems, the NEWWAVE filing rules move to alphabetical word by word classificatcn. The traditional complex grouping arrangements are gradually abandoned. Also the tendency to leave the dictionary catalogue type in the advantage of separate catalogues accelerates this process. In the new applications of NEWWAVE separate catalogues are made for personal authors, for corporate authors, for titles (including uniform titles), for subjects, etc...

6.5. THE SUBJECT INDEXING

In our library a project of translation of the Library of Congress subject headings into Dutch and French is effectuated. Starting the automation of the subject catalogue it was realized that the existing manual system was not a good basis. It was necessary to look for another solution. The two main reasons for which the Library of Congress subject headings were choosen are the following : the increasing use which is made of this system and also the advantages which are expected from the CIP data.
Up to now about 12000 subject headings are added in three languages in the authority file.

In ill. 5 an example of a subject authority record in the domain of astronautics is given. The tags 650 give the subject headings in the three languages. The original Library of Congress headings are added for well considered reasons : modifications of the headings by the Library of Congress can be easily managed in our system; most CIP descriptions will contain English language subject information and also the original version can be used as a bridge to other language versions. The tags 651 contain the so called "non retained forms". The tags 704 link the subject record with records containing narrower terms, while the tag 705 does the same for a broader term. Tag 911 enumerates the sources consulted while establishing the terminology. Finally the tag 955 indicates the number of ISBD records linked.

```
    SL                                  S:    L:     N:17-05-82          TST-33
                                                     K:16-06-83           CO-EP
TYP:  AUT:s  EDIT:  DAT:UH  -  NAT:  LANG:          TR:     OFF:
0000 054901
650AE ASTRONAUTICS AND CIVILIZATION
650BN RUIMTEVAART EN CULTUUR
650CF ASTRONAUTIQUE ET CIVILISATION
651AE CIVILISATION AND ASTRONAUTICS
651BE OUTER SPACE AND CIVILISATION
651CE SPACE AGE
651DE SPACE POWER
651EN CULTUUR EN RUIMTEVAART
704A  [144018] RELIGION AND ASTRONAUTICS = GODSDIENST EN RUIMTEVAART = RELIGIO
N ET ASTRONAUTIQUE
704B  [144017] SPACE COLONIES = RUIMTEKOLONIES = COLONIES SPATIALES
704C  [144016] SPACE LAW = RUIMTEVAARTRECHT = DROIT SPATIAL
705A  [053021] AERONAUTICS AND CIVILIZATION = LUCHTVAART EN CULTUUR = AERONAUT
IQUE ET CIVILISATION
911A  L.C./K.B./LAVAL, B.R.
955A  00001
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Ill. 5 : A subject authority record

CONCLUSIONS AND FUTURE PROSPECTS

The exchange of machine-readable bibliographic data between all types of information centres is a reality. The success of cooperation in this field is partly due to the positive results of the international standardization work in IFLA, ISO and UNESCO.

The norm for the physical exchange format ISO 2709 is well established and generally used, as well in the library as in the documentation community.

Another bibliographic standard universally accepted is the ISBD. The existence and the further development of this norm also induced and simplified many other uniformization efforts in cataloguing and in content designation. Moreover it has to be expected that the ISBD will continue to be a focal point in the establishment of future standards.

The normalization of headings, by means of internationally exchangeable authority files, although still in its very beginning phase, moves into the good direction. Cooperation will be successfull in this field if one accepts the existence, in parallel, of more than one uniform heading, each form being determined by different cataloguing rules and practices. Experiences with the processing of multilingual material in our library learn that such solutions function well. It has also to be expected that the controversy around existing norms, as for instance some of the Paris Principles, will disappear once international standard authority files come into existence.

An important problem in the field of bibliographic norms remains unresolved, namely the standardization of the content designators. Two different international formats exist : UNIMARC and UNISIST. A third format, the CCF, is in development. Relying on the actual situation, an extended use of none of these formats can be predicted for the near future. Additionally some competition exists between the library and the information and abstracting communities, concerning the content designators of the common bibliographic data. In spite of these problems, means to overcome the divergencies do exist. The cooperation between both parties has to be organized. On the one hand the responsibilities for data creation have to be strictly defined and on the other hand adequate schemes for bringing together related information have to be worked out. Concerning the distribution of the tasks, each community should concentrate on its own field of specialization : the libraries on authorities, serials, monographs etc. and the documentalists on articles, reports, theses etc. In a second phase, the dispersed and separately created data have to be joined in order to get complete bibliographic information. This can be obtained by the elaboration of efficient techniques for linking together bibliographic records of different type. None of the existing exchange formats offers a workable solution to this problem. In the Royal Library in Brussels some experience has been gained in this field. Different types of links between related records have been implemented. Finally an agreement has to be obtained on the use of the same set of content designators. Spending more time on the definition of the elements of this set makes no sense. It is not possible to define a format taking into consideration all the particular requirements.

In the standardization of filing rules many difficulties are encountered. It has to be noted however that the unbridgeable gaps of today may narrow tomorrow. Partly due to automation, a progressive simplification of the filing rules is ascertained.

Concerning the subject indexings it has to be retained that the systematic classification loses ground in

the on-line accessible bibliographic data bases. For the alphabetical subject headings no international normalized system does exist. However it is interesting to note the growing success of the Library of Congress subject headings. The predominance of one system can only be beneficial to the bibliographic information world.
Finally, although not being a project of bibliographic standardization, the CIP program has to be mentioned in this conclusion. The CIP information being distributed world-wide, together with the publications, is the promotor by excellence of the bibliographic standards.
This overview shows that some problems of normalization are left for the future, and also that none of them seems to be unsurmountable.

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THE APPLICATION OF MANAGEMENT TECHNIQUES TO DEFENCE AND OTHER INFORMATION SERVICES - THE BRITISH APPROACH

by

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1. Introduction

1.1 The original title of this paper was, "The Management of Information Services to the Defence Community - The British Approach". I felt that this was too wide, in that the management of information services covers a very wide range of topics; and too narrow, since there is no inherent difference (in the UK at least) between Defence and other information services, apart from the problem of security. For these reasons I have decided to change the title to the one given above.

1.2 I must make it clear at the outset that most of what follows has been taken from other people's work. To quote Lehrer (1), "Let no one's work evade your eyes, but plagiarise, plagiarise, plagiarise". If I have been guilty of misinterpretation of methods or results, I apologise unreservedly. If you wish to follow up any of the ideas mentioned, it is essential to read the references.

1.3 I searched the 'Aslib catalogue for books, reports and periodical articles on interesting applications of management techniques to information services and libraries, which have been published in Britain or written by British authors, and I should like to express by sincere thanks to the staff of Aslib's library, who were all extremely helpful. I have also searched the last 8 years of 'Aslib Proceedings' and carried out an on-line search of the LISA (Library and Information Science Abstracts) files. Thus this short review is undoubtedly not wholly comprehensive, but is certainly idiosyncratic. I hope that some of it will be new and will be of value to you. Most of the work I have cited comes from libraries, particularly academic and public ones, rather than from information services, because there seems to be little written by staff in the latter in this area. Nearly all the references are to British authors, but a few from the USA have inevitably crept in, such as the first and last and the seminal paper by Vannevar Bush (33).

1.4 In this paper, I have tried, to take a logical approach, from planning a new system, through measurement and evaluation, to the application of different techniques for improvement of a system, finishing with the more esoteric ones. The aim throughout has been to give the flavour of a technique rather than a detailed description.

1.5 I thank the Ministry of Defence for giving me permission to publish this paper, but nothing in it is to be construed as official Ministry of Defence or UK Government policy.

2. Planning a new system

2.1 Leitch in Section 11 of the AGARD Manual of Documentation Practices (2) includes an approach to this problem, mostly taken from Mason's work (3). She first describes how a weighting technique may be used to determine the most appropriate location for a company information centre. A use factor, e.g. on a scale of 1-6, is assigned to each section of the company and multiplied by the number of staff in that section. For each possible location of the centre, the full weight is applied for staff at the same location and half the weight for all others, and the products are summed. The location that gives the largest sum is then chosen, all other factors being equal. In practice, use of a library or information centre dies away rapidly with distance, as has been shown in a number of studies, e.g. (4), and perhaps the weighting factor of a half should be replaced by a graded one varying according to distance.

2.2 Leitch treats most of the other aspects of planning a new centre in a more subjective manner but she does show the use of a proximity table (Fig 1) to help in choosing the relative locations of the various activities within a centre.

3. Measurement and evaluation

3.1 Evaluation of an information service's activities is necessary on two counts:

(i) to determine how they can be improved,

and (ii) to demonstrate to management the value of the service.

3.2 Measurement is a necessary first step and Cloke (5) makes the very valid point that the statistics should be relevant to the enquiry. She gives as an example of the importance of taking measurements at appropriate times a situation in which children from a nearby school fill a mobile library for a short time when they come out of school and points out that it would be useless to determine slack times by measuring only the hourly issue rate. This could of course be applied in other fields.

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* Aslib was formerly the Association of Special Libraries and Information Bureaux but is now simply the Association for Information Management! It is a professional body whose aim is to promote better management of information as a resource. To do this it carries out research, provides a consultancy service, runs courses and conferences, publishes professional journals and books and answers enquiries on information management and librarianship.

For example, I knew a research establishment where most of the scientists gathered for coffee and tea breaks in a room adjacent to the library at 10.15 a.m. and 3.15 p.m. As a result, there was a fairly heavy load on the library at those times, even though the hourly issue rate was relatively low.

3.3 Urquhart (6) describes a very simple and cheap method of measuring reader's failure to find items in a library, which would be applicable to other information services. Bundles of slips were distributed throughout the library and hung on shelves so that users could record the basic details of missing documents. To supplement and check the accuracy of this, a series of interviews with readers leaving the library at peak times were held. The results were used in at least 3 ways, viz to enable the librarian to establish priorities, to help in planning changes in procedures, and to strengthen cases for increased funding.

3.4 The main object of evaluation, of course, is to improve the service to users. If information and library science was a true science one would carry out experiments by making a hypothesis and testing it in a controlled environment so that the results would be repeatable by other researchers. This is rather difficult in the information field, as pointed out by Mackenzie (7). Not only is it impossible to control an environment in which we are dealing with people (whose attitudes may change according to the state of the weather and what their spouse/lover/parent said or didn't say at breakfast) but it would be totally impossible to justify an experiment in which one group of researchers was denied access to an information service in order to measure the effect on the quality of their work, whilst others continued to use it. Moreover, it is important to beware of the 'Hawthorne effect' (8), which says that we cannot overtly study a group of people without affecting their performance. The rest of this paper aims to outline other techniques which can be used to suggest areas of improvement.

3.5 The first such technique is "illuminative evaluation". It is exemplified by Fig 2, taken with modifications from ref. 9 which describes an application to information work. This says that none of the steps is in itself likely to be new to people introducing new information services or modifying existing ones, but that systematic application of the model should provide the means for effective assessment of an innovatory programme. I ask myself, however, whether this is any different from the normal practice of good managers as exemplified by Fig 3, which was drawn up by a syndicate of which I was a member during a management course 10 years ago.

3.6 A truly different approach is the budgetary game technique described by Parker (10). As he points out, one of the problems with asking people what services they would like is that their answers are often qualitative and not quantitative. Although this can be partly solved by using ranking methods or supplying a range of possible answers they may still be able to act "like a millionaire on a spending spree". Parker suggests using a budgetary game in which a wide cross-section of users is given a limited budget and told the costs of the various services. Two examples are given. The first was an assessment of University 'support services' in which the players were told the current cost of each service and that they had to reduce the overall cost by 20%. The outcome (shown in Fig 4) was that computing services were thought to warrant 20% more expenditure, the main library (who were conducting the experiment) a 10% cut, and department libraries a 49% cut. Other services were all within the range of 3% to 43% cuts with accommodation suffering the worst. It should be noted that any services between the 0 line and the -20 line were actually being proposed for an increase in the proportions of resources devoted to them. Needless to say, these overall figures hide large differences in users' opinions. For instance, professors budgeted twice as much on secretarial support as any other grade did.

3.7 The same approach was also used to assess the relative values of information services, divided into 3 classes:

passive	-	the user knows what is wanted and the service supplies it
active	-	SDI services, standard distributions and circulations
interactive	-	on-line systems, open access libraries, etc.

Each service had 3 levels, valued at 1, 2 and 3 monetary units, and the players had a budget of 5 units. Interactive services proved to be the most desirable, and active ones the least. In addition to using their budgets players were asked to say how they rated the services at present, what options they would choose if not subject to a budget, and what improvements they had in mind for the services they thought warranted more expenditure.

4. Cost Effectiveness and Cost Benefits

4.1 Cost effectiveness is essentially the ability to provide the most effective service or a range of services for the least cost, and cost benefit analysis is concerned with assessing the monetary value of a service in relation to its cost. Much has been written on the former but there has been very little attempt to 'grasp the nettle' of cost benefits, which (to mix my metaphors thoroughly) is a very thorny subject beset with pitfalls.

4.2 One of the earliest studies of this topic in the UK was ref 11, which reviewed previous work and concluded that no really satisfactory cost/benefit study had then been carried out. It said that some useful work had been done using interview/questionnaire methods, demand analysis, and objective assessment in terms of time savings, but no investigations had really faced up to the problem of assessing the value of extra information to a firm or to society.

4.3 Most studies have been attempts to determine what potential users are willing to pay for proposed services or improvements in existing ones. At least one company in the UK has taken the decision that users must pay for information services and that the information service should be like every other department in the company and make a profit - or at least break even. This they had managed to do for 12 years by 1979 (ref 12), but it does appear from the description that the service is rather minimal as the information staff are unwilling to risk spending money unless they are sure it can be recouped.

4.4 Magson describes two approaches to measuring cost effectiveness. In the first (13) he advocates identifying the information centre's objectives and finding the current cost of meeting those objectives. This should then be compared with the cost to the company if the information centre did not exist and the objectives had to be met in other ways. He did this in an industrial company and showed a benefit of 115%. The detailed analysis of jobs he had had to carry out revealed that one post could be cut and this raised the benefit to 134%. However, I believe that some of the benefits are rather specious. For instance, he counted the number of references identified as relevant by the recipients of a current awareness bulletin, assumed that all these items would have been requested by the scientists if the bulletin had not been produced, and estimated the cost of the corresponding enquiries. In another instance, he assumed that work currently being done by the information unit could be done by another department but would take twice as long and use staff at a higher salary. I find this very difficult to accept.

4.5 Magson's later paper (14) is concerned with comparing the effectiveness of on-line systems and manual searching, a topic that has received exhaustive study in the last few years, mostly by making a comparison of precision and recall or other measures and/or costs for the same search carried out in different ways. Magson took part in a study (15) which appears to have measured costs only and to have ignored the quality of the output from the searches. In ref 14 he describes how a model of the costs was produced and programmed on a Commodore PET micro-computer. The advantage of doing this is that it enables hypothetical situations to be evaluated easily and sensitivity analysis to be performed, e.g. to determine the effect of using research scientists to carry out the searches instead of information officers.

4.6 Blick (16) describes how he evaluates aspects of his information services. For instance, by keeping a record of which items in the information bulletin are requested he has a measure of how up to date the information centre is in its knowledge of research in progress. By interviewing 10% of the scientists receiving the bulletin to determine how many vital or important items it contained and what the scientists would have had to do to obtain the information from other sources, he was able to convince his management that the cost of scientists' time saved by the bulletin was over 3 times the cost of producing it. Another approach he used was to punch edge-notched cards when carrying out a search, to indicate the topic, which sources were used for the search, and whether they produced any relevant references. From this it was possible to identify abstracts journals that were not needed or even to indicate clearly that the cost of some of the more expensive ones was not excessive in relation to their value. Incidentally, I suppose edge-notched cards would be abandoned now in favour of a micro-computer but they are a very efficient and simple tool to use in the appropriate circumstances, and do not require programming, which is always error-prone.

4.7 The point that Blick made about the necessity for monitoring how up to date is the information centre's knowledge is reinforced strongly by Vickers [illegible] who urges the information service to endeavour to persuade management to inform them of changes in policy, priorities and interests so that they can anticipate new needs instead of reacting to them only when the user suddenly demands information on a new topic - by yesterday! He says that the senior information officer must have access to the documents that give this information and should preferably participate in the meetings where changes are discussed. Griffin (12) makes exactly the same point, stating that because the head of information is part of the small group concerned with the company's forward planning they are able not only to react to new requirements but also to make unsolicited offers of information for which there may be only a latent or incipient need at the time of the offer.

4.8 Another approach to the assessment of new services is that known as BASYC (Benefit Assessment for Systems Change). This was described in a full report (18), with an appendix giving a fictitious example of how to apply the technique (19) and in a number of shorter papers such as ref 20. The technique was originally developed during a study for the UK Trustee Savings Banks on the value of investing in on-line terminals in all branches, and it was later applied to library research under British Library sponsorship.

4.9 It is a method of cost-benefit-analysis which seeks to assess the worth of alternative policies for achieving stated objectives, without insisting on monetary valuations of the benefits of the policies. 'Goals' are proposed which will provide benefit to at least some of the groups of people who will be concerned in the systems change, e.g. users and staff. The goals are ranked and weighted and a short list of up to three is formed for each group. Next, 2 or 3 strategies are defined and their effects on the goals measured, objectively where possible, both for the current situation and for optimistic and pessimistic assessments of the future. The process can be repeated 2 or 3 times to refine the weights and measures, having first identified the areas which are most sensitive to these figures and thus in need of more accurate estimates.

4.10 This is essentially a mathematical approach to decisions that are normally taken 'by the seat of the pants'. Whether or not it is any better, I leave to your judgement. It has been used in Derbyshire, once to match stocks of books and other items to the community needs of a specific branch library, and secondly to improve the service and change the allocation of funds at a library in a small town. The latter required 4 BASYC cycles.

5. Organisations and Methods (O&M)

5.1 This is perhaps the earliest of the standard management techniques for office-based work, having evolved from work study as practised on the factory floor. I found little on this topic but two examples are worth giving.

5.2 Cloke (5) claims that when one London borough was merged with 2 others to form an area with over 200,000 inhabitants, O&M helped considerably in the concomitant library reorganisation. She suggests that the first step in any method study is to take the whole task and break it into its component parts and recommends using the symbols shown in Fig 5 to produce a flow chart, e.g. as in Fig 6. This example is from public library work, but the principle could be applied to any information service. The staff concerned should be asked to keep fairly simple work diaries so that proportions of time for different tasks can be determined, and the movements required should be investigated since they are often very time-consuming.

5.3 Having established the procedure one must examine it critically, by asking:

Why is it done?	Who does it?
Where is it done?	How is it done?
When is it done?	Who supervises it?

and considering all possible alternatives to each answer.

5.4 Another equally valid question is "If it is changed, what is the effect on other processes"? This is particularly important in the use of computers, where a minor 'improvement' in one program may mean that another, possibly on a different computer, receives information in a form that it does not expect and cannot handle. It is even worse when the system makes an attempt to handle wrong data and produces unacceptable results which are not noticed until disaster occurs.

5.5 The above description applies mainly to the 'M' in O&M, but a similar approach can be used to review the organisation of the service. Brown (21) describes an unusual organisation structure used in the county of Cambridgeshire. There is a small headquarters unit in Huntingdon, the geographical centre of the area, and 4 divisional HQs in the cities of Cambridge and Peterborough and the towns of Huntingdon and March. Each division has an Assistant County Librarian (ACL) in charge and they, together with the County Librarian, his Deputy and other senior staff at Headquarters, form a Senior Management Team. Each ACL has a Professional Services Team (PST) comprising the staff responsible for circulation, information, children's libraries and schools within his area; and County Specialist Teams are formed from these and their opposite numbers in the other divisions. They each meet formally 4 times a year under the chairmanship of the Deputy County Librarian.

5.6 The advantages of this are said to be:

(i) that senior staff are involved in developing county-wide policies and problem-solving from a base of practical experience at divisional level rather than from the remote viewpoint of a county subject specialist at HQ; and

(ii) that there are two routes to the Senior Management Team. Problems can come up either through a divisional PST, or if there are internal differences of opinion within the division they can be raised within the County Specialist Team, thus providing a fail-safe mechanism.

5.7 Although this system was devised for public libraries, I believe it too could be used equally well by an industrial concern, with (say) 4 separate sites each with its own information centre.

5.8 The Library of Congress is also using a matrix management structure in its current project to determine whether optical disc technology can be used for information preservation. In this case, staff from a number of departments are also assigned to specific project groups and are carrying out their old jobs and work on the disc project. This is a further extension of the concept, and could lead to a clash of priorities, I suspect.

6. PERT/CPA

6.1 Programme Evaluation and Review Technique and Critical Path Analysis are similar procedures for scheduling work logically in a complex project. They help to ensure that no tasks are ignored, and should enable changes to be made when things go wrong. They also enable the user to determine what are the critical activities that must be completed on time if the overall project is to be finished to schedule and how much 'slack' is available elsewhere. A general term for this type of procedure is 'Network analysis' and an introduction is given in ref 22.

6.2 Cloke (5) gives a brief description of the technique as actually applied to the adaptation of a building and subsequent removal of a library headquarters to it (Fig 8). It is clear here that the critical path is 1 - 2 - 3. Another point to note is that activity 1 - 2, 'adapt the building' which is scheduled for 24 weeks actually comprises a number of subsidiary activities and may well have been the subject of a similar network diagram by the contractors. DRIC is scheduled to move to Glasgow in 1986 and we intend to draw up a network to cover this transfer.

7. Management by Objectives (MbO)

7.1 A general introduction to MbO is given in ref 23. The first stages of MbO are: firstly to clarify the objectives of the organisation; secondly to formulate strategic plans for meeting those objects; thirdly to formulate tactical plans as part of the strategic plans; and fourthly to draw-up detailed plans and agree objectives with individual managers. The managers analyse the key tasks within their units and show for each key task the performance standard by which the work is to be measured. This should be quantitative if possible although in the information field great care has to be taken over this point. For example, I receive an SDI printout each month which contains perhaps 20 items. I find it very useful, but if the number of items increased to 200 I would not value it 10 times as much. In fact my assessment of its value would diminish greatly as I would probably not read it!

7.2 The final stages of MbO are to agree what level of output is required and to monitor performance. It is essential that the objectives are not imposed from above but are agreed in discussion by the staff concerned, at all levels.

7.3 Reference 24 suggests potential uses of MbO in libraries or information services, and an actual application is described in reference 25. This report, by Hull City Libraries, says that MbO does clarify what one is trying to achieve, does enable one to set priorities, to allocate the scarce resources of time and money accordingly, and measure - albeit crudely - with what degree of success the aims are being fulfilled.

7.4 The report starts with a list of the services provided and the general programmes to whose fulfilment they contribute, e.g. the playgroup collection loan service contributes to the special groups service. Then there is a general statement of objectives, e.g. to provide suitable books for bulk loan to children in play groups (I should have thought it would be to the playgroup leaders). Finally, the objectives for each professional member of staff and each specialist department are listed, from the Chief Librarian down.

7.5 The Chief Librarian's objectives are not quantified, but are qualitative, such as "to manage and deploy resources as effectively and economically as possible, by reviewing the effectiveness of services, reviewing expenditure, controlling costs and reviewing performance". Other posts have some quantified and some qualitative targets. For example the Senior Librarian, Lending Services has, inter alia, "to supervise all aspects of the Lending Team activity by regular team meetings (52 p.a.), by receiving regular reports and discussing them with the team (12 reports), and by visiting service points to meet specialist librarians on their own ground (12 visits)". The performance measures given are (for the meetings) benefits, (for the reports) action arising, (for the visits) results.

7.6 The report finishes with a description of the community served, some 300,000 in all, including the churches, sports clubs, schools, colleges and university and even a note of the numbers of TV licences, for black and white, and colour, 133,019 and 1571 respectively - it's quite an old report! This description allows other library services to compare the level of service they provide to their communities with that provided by Hull.

8. Planning Programming and Budgeting Systems (PPBS)

8.1 Mason (26) said in 1972 that there was then no acceptable method for measuring or even estimating the value of information supplied, that a method for demonstrating cost-effectiveness was the next best thing and that in PPBS we had the necessary techniques. PPBS is designed to analyse expenditure in relation to purpose and to relate it to results achieved. Thus it follows naturally from MbO, and where MbO is being applied the information manager will already have defined his unit's objectives.

8.2 The questions to be posed are:

a. What are the objectives of the organisation?

b. What activities contribute to those objectives?

c. What resources are devoted to each of those activities?

d. What is actually being achieved?

e. How should the resources best be used in future?

8.3 The basic difference between PPBS and more traditional budgeting is that expenditure is related to the purpose for which it is being spent rather than to the resources. Thus, for instance, instead of saying how much was spent on salaries, how much on materials and how much on depreciation of machines, etc. the cost of a specific unit such as photocopying is calculated per se and then allocated to the functions it serves such as technical enquiries, distribution of reports, etc. In this way the true cost of each output can be estimated.

8.4 Mason gives a list of possible activities in an information centre (but it should be noted that he is an academic and does not run an information service for a company), as shown in Fig 9a, 9b. He then specifies the objective and procedures for each activity, as in Fig 9b.

8.5 The next step is to calculate for each activity the costs of each element, including materials and staff time. For staff costs, it is sufficiently accurate to use an average salary for the grade and estimates by the staff of the percentage of time they are involved in each of the activities. It should be possible to cross-check the salaries and costs of materials, etc. against the unit's total costs in these areas as shown in a traditional balance sheet or budget. It is a moot point whether overheads such as heat, light, rent, rates should be added. I believe they should.

8.6 This approach will show senior management the true cost of each activity and will also enable them to see the true savings that should arise when the level of a service is reduced or it is cut out entirely. Another use is to enable possible alternative services to be compared, both in respect of the cost to the information service and probable costs to the users, although the latter may be difficult to assess.

9. Operational Research (OR)

9.1 The definition of operational research given by the Operational Research Society of the United Kingdom can be summarised as:

> "The application of methods of science to complex problems, the distinctive approach being to develop a scientific model of the system, incorporating factors such as chance and risk, with which to predict the outcome of alternative decisions. The purpose is to help management determine its policy and actions scientifically".

It must be stressed that it is necessary to validate the model carefully or totally incorrect results may occur. Two books on the application of OR to libraries are refs. 27 and 28. Both were published in the USA but one is written by two Britons and the other is edited by three Britons and contains many British articles, so I feel justified in quoting from them.

9.2 An early example of the application of OR to libraries was given by Urquhart (29) when he assumed a Poisson distribution for the demand for periodicals and used it to compare the concepts of a national lending library for serials and a number of regional centres. It showed quite conclusively that the former would require far fewer copies to ensure a 95% availability on demand. This work was used as the basis for setting up the National Lending Library at Boston Spa (now the British Library Lending Division) and determining how many copies of each periodical should be held.

9.3 A more recent application has been described by Hindle (30), where the aim was to increase the availability of books in a university library. Two measures of availability were used: satisfaction level (S), the proportion of demands which could be satisfied immediately; and collection bias (B), the proportion of the most popular 10% of the library's stock which were off the shelves at a given time. At the time the study was undertaken the library issued nearly all books until the end of term but limited the number of books anyone could hold at one time. This appeared to work well; there were few complaints and it did not require much effort in the library. However a survey showed that S was 60% and B 45%, and the Librarian said that these figures were unsatisfactory and should ideally be 80% and 20% respectively.

9.4 After discussions with other university libraries it appeared that books were generally held until the end of the loan period and not then renewed, whether the period was 1 week or a whole term. On this basis a computer model of the loans system was built, assuming a Poisson distribution of requests, and this was used to analyse various different policies. The one finally adopted, which seemed to be a new concept, was to determine loan periods by popularity. Some 10% of the collection generated 70% of the loans and these were restricted to a one-week loan period, the remainder being available until the end of term as before. The model suggested that this would give S = 86% and B = 8%, and the implications in terms of staff cost were not considered excessive.

9.5 The results have been very encouraging. Total issues almost doubled, although the student population rose by only 25%, and there are hardly any extra renewals. It appears that greater availability has resulted in much greater use of the library, a very positive gain. Prediction of future use of each book was based on an analysis of past use and this has been found to be successful. The Centre for Library and Information Management at Loughborough is now working on a means of predicting in advance the level of book use. A report will be issued jointly with the City of London Polytechnical soon (30A).

9.6 Theoretical uses of OR in libraries are given in ref 27. The example on p.52 is an application of queuing theory. If on average 15 customers come to an enquiry desk per hour and the service time averages out at 2 minutes then the probability of a queue is only 1/2 and the average time a customer spends in a queue is 2 minutes, assuming a Poisson arrival pattern. If the numbers arriving increase by one half to 22.5 per hour, the average queuing time trebles to 6 minutes, but if the service time increases by one half to 3 minutes, the average queuing time increases more than four times to 9 minutes, showing that queuing time is much more sensitive to increases in service time than is arrival rate. However, it should be noted that the queuing time becomes infinite if either the rate of arrival or the service time doubles.

9.7 Linear programming and related techniques such as integer and dynamic programming also have a place in the analysis of information services. A theoretical example of the use of linear programming is given in Ref 27, p.58 et seq. It relates to an information centre that produces two types of current awareness service and wishes to maximise its profits. The arguments are in fact flawed but the principle is clearly described, as is the graphical method of solution.

9.8 Two other theoretical and somewhat unrealistic examples are given on p.67. Both have only two variables and so are amenable to a graphical solution. If there are more than 2 variables, non-graphical techniques are needed to solve linear equations, but manual and computerised methods can both be used.

9.9 Ref 27 also discusses the use of decision theory with the aid of an example relating to hypothetical maintenance agreements for machinery (see p.86). It suggests various ways of making a decision, most of which give different results, but leaves it to the manager to decide which to use. The use of mathematical rigour in this sort of situation tends to leave one with the feeling that an intuitive approach might have been as good.

9.10 A very valid point made at the end of this reference is to tackle a simple problem first to evaluate OR and learn more about its application to a library or information unit. But it must be a meaningful problem so that the impact of the technique and its success or otherwise can be identified.

9.11 Arms (31) describes earlier work by Morley which considers two services with marginal costs C_1, C_2 and benefits B_1, B_2. In general it will be possible to establish C_1 and C_2 as for PPBS, but B_1 and B_2 will be intangible. However, if we assume $C_1/B_1 < C_2/B_2$ then by decreasing the amount of service 2 and hence C_2 the money saved can be used to increased C_1 and thus increase the total benefit, a process which could of course be carried on (in theory, at least) until C_2 was given up. The benefit then would be $B_1 + KB_2$ (where K (> 1) is the ratio of C_2/B_2 to C_1/B_1). Thus if the overall service is to give the maximum benefit in relation to costs the ratio of costs to benefits must be the same for each subsidiary service.

9.12 From this we are able to make statements about services or aspects of services with equal costs and say that running them in their present way is equivalent to assuming that their benefits are equal. For instance it might imply that the value of one issue of a current awareness bulletin is equivalent to that of 20 on-line searches. Presenting implications such as this to managers may help them to make better use of their resources.

10. Expert Systems

10.1 This topic, which is passionately supported by some scientists, such as Professor Michie at Edinburgh, and equally as passionately denounced by others as being of no real value, is a branch of artificial intelligence. One of the best-known expert systems, MYCIN developed at Stanford University and used at a local hospital to diagnose infectious diseases and recommend prescriptions, is essentially an aid to physicians. It assumes specific diagnoses, then asks about the patient's symptoms and physical condition, until it can determine with a fair degree of certainty what he is suffering from. Another well-known system, allegedly in commercial use, is PROSPECTOR which acts as a consultant geologist in mineral prospecting. Bigger and Coupland's bibliography (32) is a good introduction to the subject and its diversity. An expert system is perhaps the technique most likely to produce a 'MEMEX', as discussed by Vannevar Bush (33).

10.2 Davies (34) has written a short description of expert systems and refers to other authors who have suggested their use as an aid to helping on-line searching or the use of on-line catalogues. He is sceptical about these possibilities and comments that it is not obvious that it would generally be quicker to get answers from a machine than from a librarian. But if the librarian were not available, perhaps an expert system would be of value. Davies quotes another author, who has suggested that the use of expert systems in tax law retrieval systems may start soon.

11. System Dynamics

This is a computer-based technique for simulating complex interacting systems. It first came to popular notice with studies by the 'Club of Rome' on the future of the world (35). Coyle of Bradford University (36) has given a good introduction to the technique and Heseltine (37) has suggested applications to the information world. A fuller report is given in ref 38. Heseltine says there are two main purposes: to clarify the structures and operations of a system; and to suggest ways of improving its behaviour. Although the second is important, it is often the first that yields the most useful results.

11.2 The basis of system dynamics is an 'influence diagram' which shows all the variables in the system and connects them by arrows indicating the direction of influence or causation, but not the actual flow of materials. Other aspects to be included are: 'feed back' where the output from one item influences an input to the system, e.g.'waiting time for a search' influences 'number of users'; and 'control loops', where the present state of an item is compared with the desirable state and discrepancies lead to an adjustment of another item, e.g. if the search capacity is too little, more staff time may be allocated to searching. Fig 10 is an example of an influence diagram for the financial aspects of an on-line search service. Feedback is shown by dashed lines and control by dashed/dotted lines.

11.3 Heseltine says there is no reason in principle why system dynamics should not be used to model a total library or information service, and it would provide valuable insights into its operation. He stresses the importance of long-term planning in this context.

11.4 Feedback and control are modelled by means of mathematical equations so that a complete simulation of the system can be performed on a computer. An important aspect of system dynamics is to ensure that the policies are 'robust', i.e. that the system will perform in the same manner, although the actual numerical values may be different, no matter what shocks are delivered from outside.

11.5 If the system doesn't behave in this way, we are entering the realm of Catastrophe Theory (39), which is not so much a management technique as a means of understanding why some systems show sudden and dramatic changes in behaviour, as when a crowd suddenly becomes a rioting mob. I have found no reference to this topic in the information field but I believe that it may have some application. For instance if staffing is not increased at a sufficiently fast rate to match rises in demand, a service may collapse completely. And the same is true in present economic circumstances if staffing or funding is reduced at a considerably quicker rate than the fall in demand.

12. Simulation Models and Games

12.1 Simulation models are very useful, if constructed with sufficient detail, for enabling a manager to make changes in his service, e.g. number of staff or types of service, and observe their effect, without having any effect on the user. But care must be taken to validate the model thoroughly on present procedures and attempt to ensure that it has been constructed carefully so that it really does reflect what is likely to happen in real life. A model of this kind was built by Thomas (40). It attempted to simulate a wide range of libraries and incorporates such features as volume of items processed, loan periods, recall policies, frequency and duration of tasks, lunch breaks, shift work, annual leave, staff sickness and movement of staff and their replacement. Management information provided included histograms showing the utilisation of the time of each library assistant, queue statistics, time spent on issue counter work, tables showing the length of time various transactions had been in the system and the time elapsed in each of selection, ordering, receipt and processing. It was even detailed enough to show the average contents of each trolley of books! The model was validated on an actual library and was of help to the Librarian when he had to decide how to replace an experienced member of staff who had left.

12.2 The model described by Hindle (30) has been developed further into a gaming tool for educating librarians (41). The aim is to teach them the effects of different loan periods and duplication policies. As well as the features mentioned in ref. 30 it now includes obsolescence of books and provision for purchase of new ones, and can run several years into the future. It includes an increase in the amount of use made by each library user as performance improves. Performance measures given are total cost, number of issues, availability of requested items, collection bias and document exposure. The last is a negative exponential distribution which says that if a book is borrowed for 1000 hours the amount of use (exposure) will be about 5 hours and if the loan period is doubled the exposure will be 5½ hours, beyond which it does not rise. This is an artificial measure but is probably based on reality since most use of text books is shortly after they are borrowed and just before they are returned!

12.3 Most of the characteristics of the model are variables and can be changed to simulate different situations, and up to 10 people can participate interactively at one time. Other games that have been developed by Lancaster University are a book processing game and an inter-library loan game.

12.4 A different sort of game is that described by Chapman (42), in which library staff play roles, both as caricatures of library staff and as difficult customers. This helps to train the staff to be sensitive to people and situations, and stimulates discussion of possible improvements both in their attitudes and in the services provided by the library. The use of role-playing should ensure that no individuals believe they are being specifically criticised.

12.5 A combination of simulation and role-playing has been described by Guy (43). It started as an attempt to use the moving of Salisbury City Library to a new building as the basis of a management game. After criticism that it was already out-dated because of local government reorganisation, a fictional simulation was developed. It is now much more flexible and allows tutors to design their own problems. The essence is that by playing roles in syndicates, solving problems, and listening to others' solutions, the students learn about management, decision-making and inter-person and group communication.

13. Delphi Techniques

13.1 I have found only one reference to use of this technique, which is essentially a method of making predictions using a number of experts; Kennington (44) used it to predict future changes of direction in the public library field. Twenty four professionals who had achieved a high level of success in the library or information field, or were thought to have the potential to do so, were selected by a vote by members of the Public Libraries Research Group. They were then asked to make statements about the future. Some 400 were submitted, which were reduced to 250 by removal of duplicates. Each member of the assessing team was then asked to say whether he agreed or disagreed with each statement in turn, and if the former, approximately when he thought the change would start, when it would be taken up by half the number of libraries, and when it would be virtually complete.

13.2 The team were actually given 3 possibilities to choose from: basically agree; basically disagree; would not happen before 2005; three answers which are not mutually exclusive. However, despite this potential difficulty all the team managed to decide on only one answer to each statement, possibly with different interpretations of the meaning of the answers.

13.3 The statements covered a wide range of topics. Examples are "Collaboration among various kinds of library will be extended" (result 24, 0, 0), "Reading for entertainment will disappear" (1, 22, 1) and "Facsimile will be used between libraries and callers with equipment. Personal callers will still be welcome, but most contacts will be by telephone" (8, 7, 8). The last is actually 3 statements, not one, which may account for the spread of responses.

13.4 There are no conclusions in the paper and I do not believe the results will help public libraries much in their future planning.

13.5 This was not a true Delphi experiment since there are normally 3 or 4 rounds, with each respondent being told the ranges of responses from the others or that he can change his views if he wishes. I have grave doubts about the value of Delphi generally and would welcome examples where its predictions have later been confirmed.

14. Bradford's Law

14.1 Bradford's Law was first enunciated in 1934 (45). It has two formulations which have since been shown to differ. The theoretical one is, "If scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the number of periodicals in the nucleus and succeeding zones will be as $1 : a : a^2 : \ldots$". The graphical formulation was a plot of the cumulative total number of articles R(n) against the logarithm of the number of periodicals (log n), which was very nearly a straight line, after an initial curve. The two formulations can be shown to be equivalent to:

$$R(A) = j \log (n/s + 1)$$

$$R(n) = k \log (n/t)$$

respectively, where $j \neq k$ and $s \neq t$. Wilkinson (46) has tested the formulations on 4 different topics and concluded that the graphical formulation most closely fits the observations.

14.2 Brookes (47) has suggested an interesting use of the 'Law' to predict the number of periodicals required to cover a given fraction of a subject area or of a search, or to determine which periodicals an information service should subscribe to and which it should obtain from a national service for individual articles as required. He used the graphical formulation.

14.3 To finish with an article from the USA, Drott (48) has carried out a considerable study of the accuracy of the law and confirmed that all the searches investigated fitted the graphical formulation very closely, with very strong correlations between k and the total number of articles retrieved and t and the number of journal titles retrieved. So the theoretical uses proposed by Brookes may have some practical value.

15. Conclusion

15.1 This papsr has covered a wide field very sketchily, because of limitations of time (to prepare it) and space (to be a reasonable length). It has attempted to give a flavour of work in the last 10 years in the UK. One aspect has been noticeable. Most of the theoretical studies have been carried out by academics or Aslib staff and the practical applications described have mostly been in the public library field. I have found very little from governmental or industrial sources. Why?

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	Entrance	Service desk	Library office	Information office	Catalogue	Reports index	Reports file	Periodicals: current display	Ready-reference collection	Abstracts	Periodicals	Monographs
Entrance		3	3	2	2	2	2	3	3	1	1	1
Service desk	3		3	3	3	3	3	2	3	1	1	1
Library Office	3	3		2	3	2	2	3	2	1	1	1
Information Office	2	3	2		2	3	2	2	2	3	2	2
Catalogue	2	3	3	2		2	1	1	2	1	1	2
Reports Index	2	3	2	3	2		3	1	1	1	1	1
Reports file	2	3	2	2	1	3		1	1	1	1	1
Periodicals: current display	3	2	3	2	1	1	1		1	2	2	1
Ready-reference collection	3	3	2	2	2	1	1	1		1	1	2
Abstracts	1	1	1	3	1	1	1	2	1		3	2
Periodicals	1	1	1	2	1	1	1	2	1	3		1
Monographs	1	1	1	2	3	1	1	1	2	2	1	

3 = must be close 2 = should not be too far away 1 = need not be close

Fig 1 A proximity table

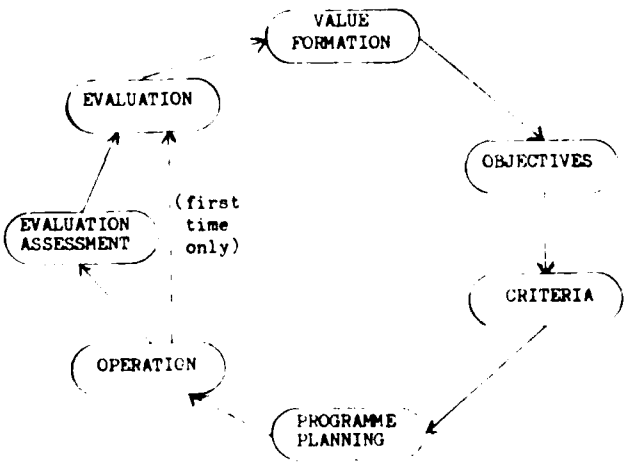

Fig 2 Illuminative Evaluation

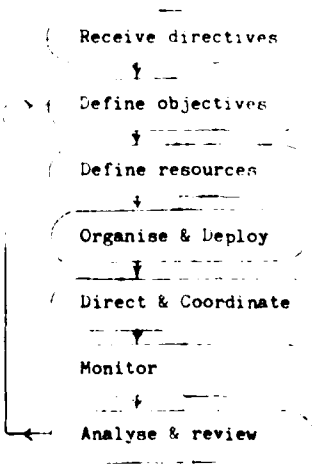

Fig 3 What do managers do?

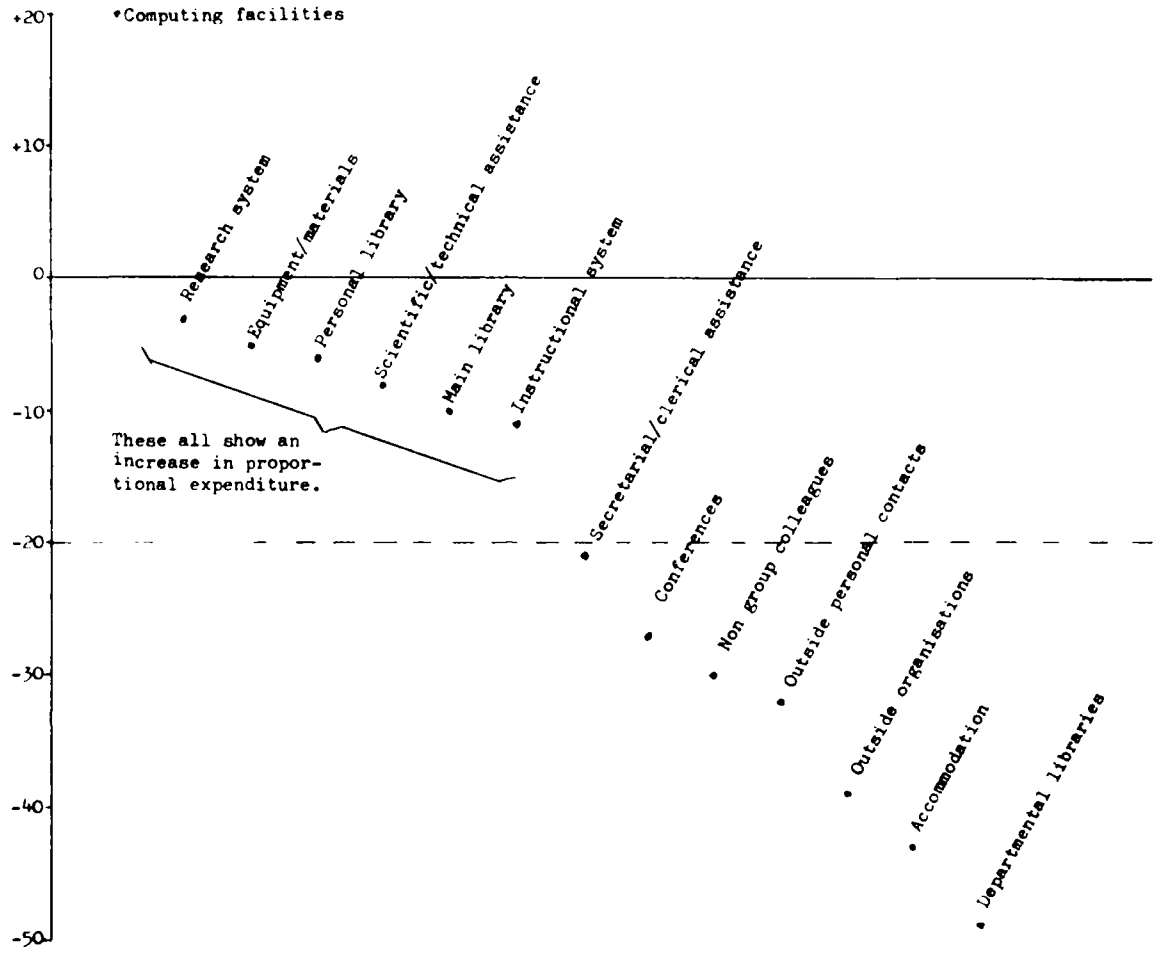

Fig 4 Outcome of a Budgetary Game

Activity	*Main result*	*Symbol*
Operation	Accomplishes Produces a change Furthers a process	○
Inspection	Verifies quantity quality or condition	□
Transport	Travels	▷
Storage	Holds keeps retains	▽
Delay	Interferes or delays	D

Fig 5 Flowchart symbols

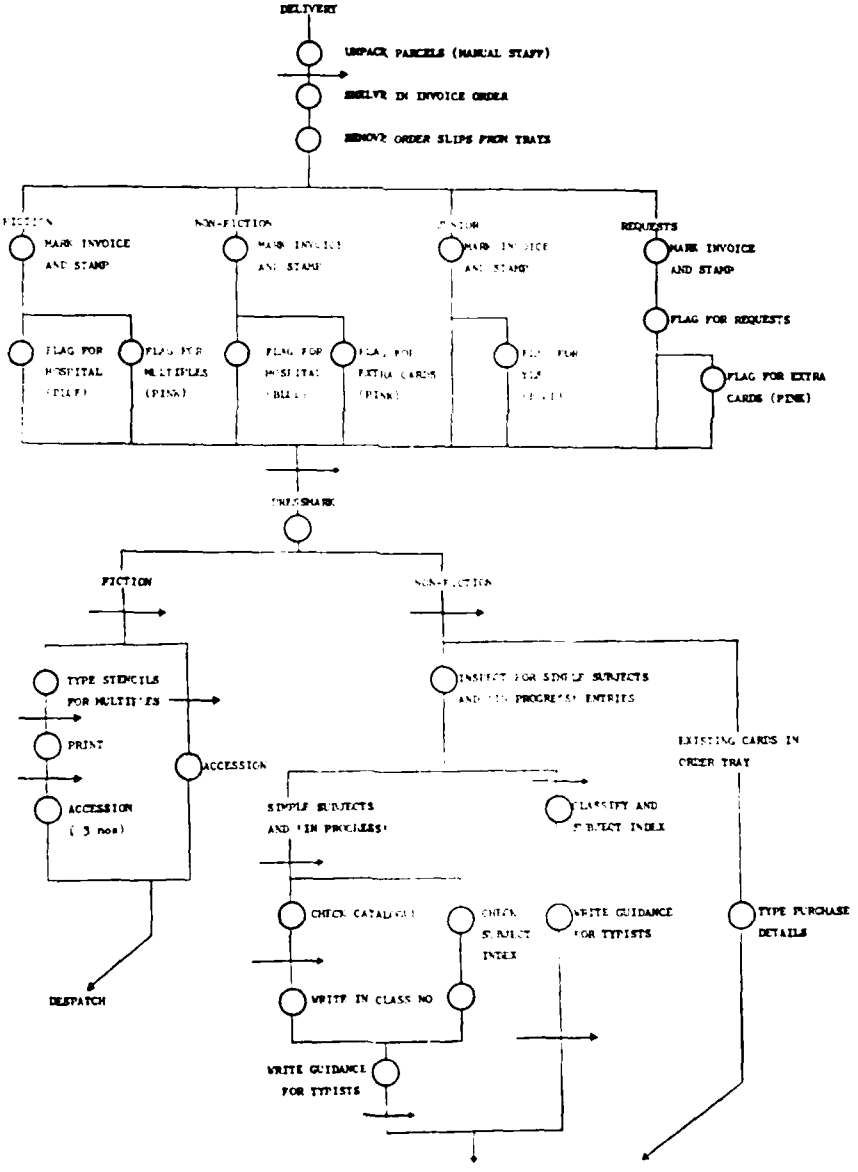

Fig 6 A flowchart of receipts

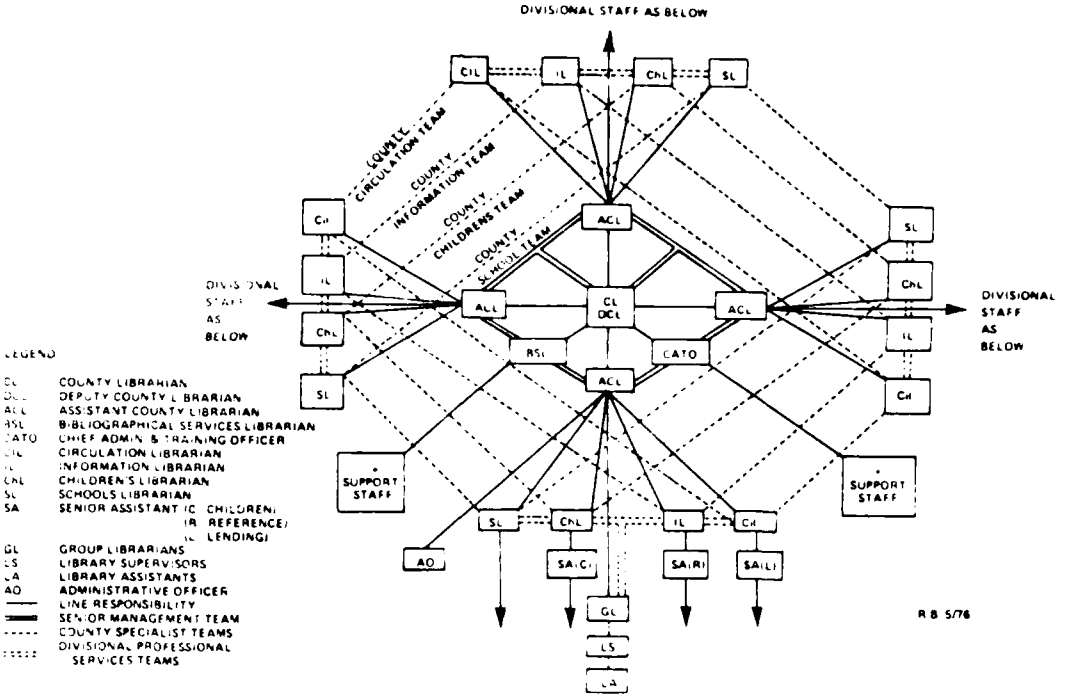

Fig 7 Management structure of Cambridgeshire libraries

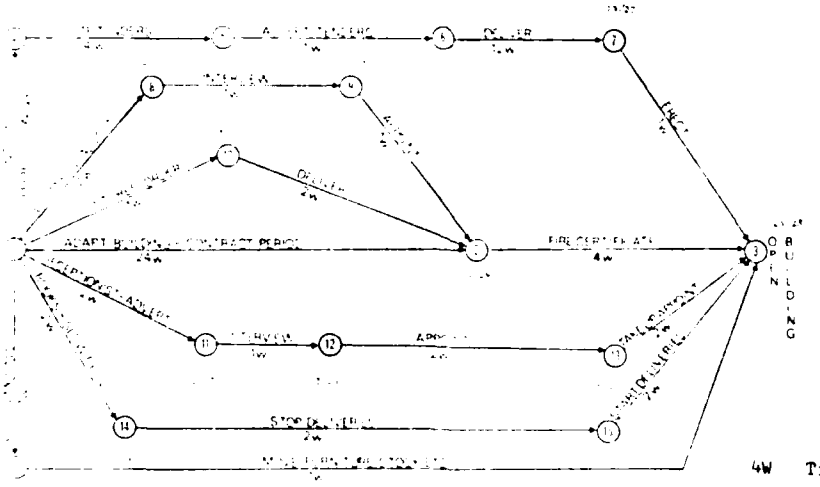

Fig 8 A simplified critical path diagram

Operational Activities

1.0 Acquisition of materials
2.0 Preparation of indexes
3.0 Stock control & maintenance
4.0 Services & systems (Evaluation & research)

Service Activities

5.0 Current awareness
6.0 Information retrieval
7.0 Reference & loan
8.0 Supply & distribution
9.0 Training & advisory

Fig 9a Typical activities

Element 1.1 Acquisition of Materials (books & pamphlets)

Objective: To acquire, by purchase or otherwise, and to record the receipt of, the books, pamphlets, government publications, trade literature, standards, etc. needed to support or provide the requisite information, reference and loan services.

Procedure: Bibliographical details of the required publication are verified; the appropriate bookseller or other agent is selected; an order is typed and despatched. On receipt the publication is checked; receipt is recorded; and the invoice checked and passed for payment.

Fig 9b Objectives and procedures

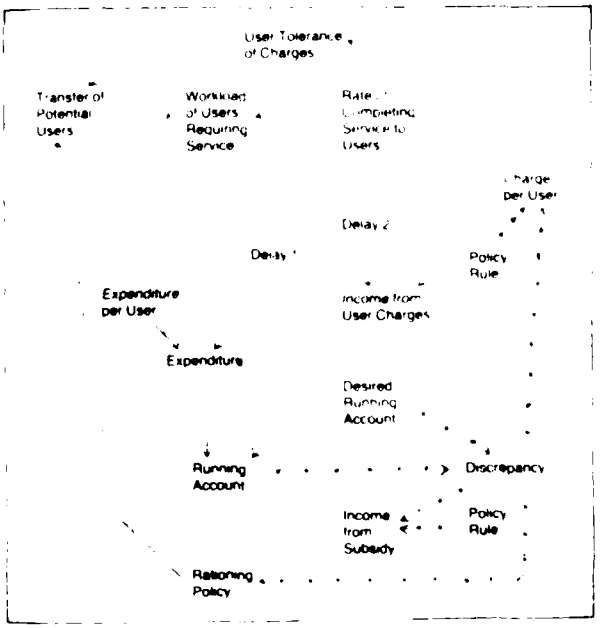

Fig 10 An influence diagram

MANAGEMENT OF AEROSPACE CONTRACT DOCUMENTATION BY INDUSTRY AND GOVERNMENT

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Summary

The paper reviews methods of documenting and tracking contract requirements and deliverables from the inception of a project through its completion. One specific system, the Technical Information Monitoring System, will be discussed in detail. Emphasis is placed on the tracking of deliverables in the form of technical reporting requirements for research and development contracts for the U. S. Department of Energy. In addition, the paper concentrates on the application of new technologies to improve productivity and reduce overlap in energy research and development and to enhance contract documentation and accelerate the dissemination of contractor research and development reports and technical information.

The primary mission of the U. S. Department of Energy's Technical Information Center is to collect, organize, and disseminate as appropriate the results of Department-funded research and development in all technical areas including defense, nuclear, and other energy-related fields. We accomplish this mission largely through the computerized processing of descriptions of Research in Progress and through the processing and announcement of technical reports that are published as a result of research and development projects.

Although we are a part of the Department of Energy, over 57% of our budget is defense oriented. In addition, in 1982 approximately 20% of the unclassified and virtually 100% of the classified citations processed at the Technical Information Center were defense related. As a result, we have many technical information interests in common with the AGARD Technical Information Panel.

To understand the management controls on contract documentation, we must examine the contracting process. In the Department of Energy, the two basic types of contracts are the single, or nonintegrated, contracts and the integrated contracts. Each contracting system is covered by a separate set of rules, regulations, and authorities. Integrated contracts are the large umbrella contracts that the Department negotiates with corporations, primarily for the operation of government-owned national laboratory facilities, national museums, and research centers. The integrated contracts are normally mission oriented with several layers of tasks and subtasks defined for each project within the mission. On the other hand, nonintegrated contracts normally are in one specific research area and are limited in scope.

The nonintegrated contracts require two forms that are directly related to contract documentation. The first, "Notice of Energy RD&D Project" (Appendix A), reports on research, development, and demonstration projects in progress and is sent directly to the Technical Information Center to be included in the Research in Progress Data Base. The second form is "Reporting Requirements Checklist" (Appendix B), which details all deliverables required by the contract, including technical information reporting requirements. Deliverables include all tangible items that must be delivered to the Government as a result of the contract work. In the case of research, most deliverables are in the form of technical reports. This form, listing deliverables required, is sent to Department Headquarters where it is entered into the Procurement and Assistance Data System, a data base containing administrative information about all Department contracts.

Under an integrated contract, each task is reported through the program official who administers that particular part of the contract. Each project supervisor must submit annually a Field Task Proposal (Appendix C) that details the scope and funding of the task. The Field Task Proposals are sent to the Headquarters Program Manager via the Technical Information Center, where the information is captured and entered into the Research in Progress Data Base.

In addition to the Research in Progress Data Base, the Technical Information Center maintains several other data bases that are related to contract documentation. Among the most important of these data bases are the Contract Number Authority, the Reports Holding File, and the Tracking, Resources, Analysis, and Control System.

The Contract Number Authority is a data base of all Department of Energy research and development contracts. The authority is updated monthly by tape from the Headquarters Procurement and Assistance Data System. This information supplements other data input at the Technical Information Center which are related to the receipt of deliverables in the form of technical reporting requirements. Currently, we are tracking over 20 000 research and development contracts in the Contract Number Authority. The actual

data base is broken into three related files containing a total of 57 separate data fields. Representative fields include the following data elements:

Contract Number	Corporate Name
Award Date	Corporate Division
Award Amount	Corporate Address
Description	Dunn and Bradstreet Number
Technical Representative	Several Phone Numbers
Award Administrator	Reporting Requirements
Senior Investigator	Last Date of Change
Project Manager	Reporting Requirements Met

The present Contract Number Authority is the third generation of this data base. The first version was a combination of Fortran and Assembler; the second was a Data Base Management System interfaced into Assembler; and the present version is on a Data Base Management System in its entirety.

The Reports Holding File is a data base of all reports held by the Technical Information Center which were received after 1976. This is a second generation data base designed entirely on a Data Base Management System and searchable by practically every data field. The original version was written in Fortran and could be searched only by the report number.

The Reports Holding File currently contains information on almost 300 000 reports, the majority of which are Department of Energy reports published as a deliverable on a Department research and development contract. Owing to the physical size of the data base, the data base is broken into four identical files. Each entry in the data base contains 24 fields. A representative sample of the data elements in each field is as follows:

Report Number	Availability of Report
Contract Number	Number of Copies Received
Department of Energy Accession Number	Classification
Date of Report	Origin

The Tracking, Resources, Analysis, and Control System--known more simply as the Report Tracking System--is a combination of human interfacing, hardware technology, and computer data bases. This system permits Department contract officers and management to obtain data instantaneously on any technical information contract deliverable. Also, the system permits the computer to produce management control and documentation reports giving the location of any deliverable for a technical information contract, provided the deliverable is in the Technical Information Center processing cycle.

The basic concept of the Report Tracking System is to assign a unique Department of Energy accession number to each report deliverable and to use this number to track the deliverable through the system. When each contract deliverable arrives at the Technical Information Center, we put the document in a folder with a label that is coded in the universal optical recognition format. At the same time, we establish which of several standard routes this particular document will follow. Then, the document moves from one processing station to another (potentially 20 different functions), and the location of the document is tracked as follows. At each station a bar-code reader consisting of a ruby wand and an asynchronous ASCII character generator transmits the code on the label to the host computer through a multiplexer. The multiplexer generates a time stamp and a station identifier that is passed to the host computer along with the information generated by the bar code reader. Software in the host computer generates a data base record that is updated to the Document Tracking Data Base. From this update procedure, several important determinations can be made concerning the status of the document being tracked. The first determination is the real-time location of the document. Since a predetermined standard route is already associated with the document, we can also determine whether the document is staying on its assigned route and whether any stations have been missed.

Although each of the preceding systems is a stand-alone entity within itself, the systems use common terminology and syntax and have been designed to interrelate with other systems so that control of contract documentation is integrated into the overall Technical Information Center technical information management function. The name we have applied to this concept is the Department of Energy Technical Information Monitoring System. I would emphasize that the monitoring system itself is not a data base or even a stand-alone system. It is rather a concept of the relationship and the integration of the individual data systems of the Technical Information Center which make monitoring of technical information contracts a reality. The integration of this concept with other services at the Technical Information Center makes possible several extremely useful functions for the Department. First, by periodically examining the technical information reporting requirements for contracts which are in the Contract Number Authority, we can determine the deliverables that are due at the Technical Information Center. In turn, if we examine the type of deliverable, i.e., monthly, annual, or final technical report or Notice of Research and Development in Progress, the software enables us to check the Reports Holding File and the Research in Progress files and to determine delinquent deliverables for each contract. In addition, checking the Contract Number Authority for the responsible program manager gives us the proper official to be notified of the delinquencies. Appendix D shows a typical delinquent report.

Another tool of the monitoring system is an online query program that permits program managers to query the data bases from several perspectives: to establish which reports have been printed from each contract; to determine which contract produced a specific report; or to obtain any other information concerning contract documentation that will be useful to the project manager. Appendix E shows a typical terminal session in the query system.

By designing an interrelated set of data bases and files for contract documentation, we have gained several other fringe benefits for our main processing system. The technical results of research and development projects can be bibliographically described, abstracted, and indexed and ultimately can be announced through the Department's technical abstract journals and also made available for online searching on the Department's Bibliographic Energy Data Base, which contains the world's largest collection of citations of international energy research and development. Several controls can be placed on the data processing cycle to ensure accuracy of the data before they are released to the user community. For example, each contract number in the bibliographic stream is validated against the Contract Number Authority. Each Department accession number and report number is validated against the Report Tracking System. In addition, the design of the Contract Documentation System has permitted us to design an Incremental Input System for the bibliographic data which permits a relational definition of the bibliographic data to information in several of the Technical Information Monitoring files. As a result we make significantly more efficient use of personnel, obtain more accurate data, and virtually eliminate the redundant keying that inevitably creeps into a complex data processing system.

Now that we have examined the management of contract documentation from the government perspective, we need to review the management of contract documentation from the industry perspective.

The Technical Information Center's responsibility related to the management of contract documentation by industry is the oversight and appraisal of contractor and Department technical information functions. The primary objective of this program is to ensure that the Department's technical information is being documented, collected, controlled, and disseminated in a manner that enhances the Department's multibillion dollar annual research and development effort. The primary appraisal methods are onsite reviews and statistical comparisons of the information products of the organizations performing work for the Department. The various automated systems previously discussed provide an abundance of statistical data that benefit the appraisal, contract management, and program management by the responsible Department officials.

From the contractor's perspective, contract documentation and contract management are major efforts because of the previously mentioned reporting systems for contractor information and the fact that a great deal of the contractor's efforts is performed under subcontract. Accordingly, the Department's contractors utilize many of the same technologies used by the Technical Information Center. Online contract management and technical information data bases are commonplace at major contractor sites.

Most contractors maintain a separate staff organization to manage the contract administration function. The contract organization is normally closely aligned with the financial organization(s) and uses many of the same information systems, i.e., financial, planning, production statistics, etc. Since technical information is the primary deliverable under a research type contract, the technical information function is usually performed by a completely separate organization consisting of a technical information department and associated library. After the contract management staff has executed the contractual agreements and has incorporated the appropriate technical information reporting requirements, the technical information department is responsible for ensuring that technical information systems and procedures are followed within the organization and that the contractual requirements pertaining to technical information are satisfied.

Another essential function of the contractors' technical information departments is the operation of the technical libraries. The libraries form the nucleus of the flow of research and development information among researchers of the same organization and serve as the primary interface with the centralized technical information system of the Department. The Technical Information Center's data bases are normally accessed through the libraries of the research contractors, and many of the technologies applied at the Technical Information Center are developed in coordination with the libraries.

The high technology systems that have been developed not only provide a sound basis for the appraisal of the Department's technical information function but also provide contractors with the mechanisms to manage their own contract and technical information functions.

In summary, by careful planning of contract administration and by taking advantage of hardware and software innovations, the Department of Energy has been able to implement a system that answers both the needs of local management for monitoring all aspects of processing technical information contract deliverables and the needs of Headquarters program management to properly monitor all technical information aspects of contracts. In addition, by careful consideration of the relationship between the contract documentation and bibliographic processing, we have been able to design a truly integrated system with significant savings in manpower and money.

APPENDIX A

FORM DOE 538
(Rev 10-89)

U.S. DEPARTMENT OF ENERGY

NOTICE OF ENERGY RD&D PROJECT

APPROVED FOR USE BY
SMITHSONIAN SCIENCE INFORMATION EXCHANGE

FORM APPROVED
OMB NO. 38 R-0188

1. Descriptive title of work

2. Performing organization control number _____
Work status ☐ New ☐ Continuing ☐ Terminated

3. Contract or grant number

4. Contractor's principal investigator/project manager and address where work is performed
A. Name (Last, First, MI) _____ B. Phone: FTS- _____
C. Research organization
business address: Street _____ Com.- _____
City _____ State _____ Zip _____

5. A. Name of performing organization _____ (Organization) _____ (Department)
B. Mailing address (If different from 4C)
C. Circle only one code for TYPE OF ORGANIZATION PERFORMING R&D (See instructions):
CU FF IN NP ST TA US XX EG
D. Location where the work is being performed
E. Country sponsoring research

6. Supporting organization
A. Program division or office (Full name) _____
B. Technical monitor (Last, First, MI) _____ C. Phone: FTS- _____
D. Address (If different from DOE Hqs.) _____ Com.- _____
E. Administrative monitor (Last, First, MI) _____

7. Project schedule
A. Start date _____ (Month) (Year) B. Expected completion date _____ (Month) (Year)

8. Funding in thousands of dollars (Funds represent budget obligations for operating and capital equipment)

	Funding organization(s)	Current FY ____	Next FY ____
A			
B			
C			

D. For DOE projects, enter budgeting and reporting classification code _____
E. Interagency agreement (Specify funding agency) _____
F. Agency in-house effort (Check if applicable) ☐ _____
G. EPA "pass-thru" funding (Check if applicable) ☐ _____

Note: Funding Section utilization is optional on Federal Financial Assistance Programs, grants, direct payments, cooperative agreements, loan guarantees, and other related programs.

9. Descriptive summary of work (Limit to 200 words. Include objective, approach, results to date and their significance, and expected product. Quantify where possible).

10. List the five most descriptive publications in the last year that are available to the public which have resulted from the project (Please give a complete bibliographic citation. Use additional sheets if necessary).

11. General technology categories (Enter applicable code of codes from instructions).

☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

12. Type of research activity (Check applicable activities)

A. ☐ Basic research
B. ☐ Applied research
C. ☐ Laboratory scale R&D
D. ☐ Technology development
E. ☐ Field study
F. ☐ Pilot plant scale R&D
G. ☐ Full scale demonstration
H. ☐ Mathematical model development
I. ☐ Data analysis/assessments
J. ☐ Information systems management
K. ☐ Policy analysis
L. ☐ Socioeconomic
M. ☐ Other (Specify)_____
N. ☐ Not applicable

13. keywords (Please list 5 keywords).

14. Is this research project solely an ANALYTICAL/PAPER STUDY?
(Non-experimental, paper and pencil, computer analysis, etc.). YES _____ NO _____

15. Respondent's Name: _____ Phone No.: _____ Date: _____

Street: _____

City: _____ State: _____ Zip: _____

U. S. G P O 1980-720-050/4616

INSTRUCTIONS
NOTICE OF ENERGY RD&D PROJECT

NOTICE

If in the past six months you have completed an Inventory of Federal Energy Related Environment and Safety Research or programmatic office project description, complete only the new data element on this form and send it and a copy of the form completed earlier to Department of Energy, Technical Information Center, Post Office Box 62, Oak Ridge, TN 37830

1 DESCRIPTIVE TITLE OF WORK

Be as specific as possible. Since an index in the published inventory is generated from words in the titles, use words that are descriptive of the work done. Please limit the length to a maximum of 100 characters plus spaces.

Example: "Design of a Better Mousetrap" not "Pest Control"

2 PERFORMING ORGANIZATION CONTROL NUMBER

A unique internal identification number that is used by the performing organization to facilitate project control. If the organization uses no number, this space will be left blank. PROJECT STATUS: Check status of project.

3 CONTRACT OR GRANT NUMBER

The DOE contract or grant number under which the work is being performed. For WPAS type projects, the master contract number should be inserted. Inter agency agreements use the IAA number.

4 CONTRACTOR'S *PRINCIPAL INVESTIGATOR/PROJECT MANAGER AND MAILING ADDRESS WHERE WORK IS PERFORMED*

Name of person chiefly responsible for the performance of the project or who is most familiar with this project. Persons should be permanently employed by organization (not summer employees or graduate students). Give telephone number, including area code and extension (if you have FTS number, please include it), at which the principal investigator can be reached. The address should be for the person at the specific facility doing the work.

5 A *NAME OF ORGANIZATION*

In large organizations that have several levels of subdivision, or subsidiaries, include the name of the smallest autonomous unit performing the research. For universities, include the name of the specific school, departments, etc., *where the research* is being done.

Examples: Halliburton Company, Otis Engineering; University of Maryland, Institute of Fluid Dynamics and Applied Mathematics; "U.S. Department of Defense, *Air Force Cambridge Research Laboratory*"

B MAILING ADDRESS

Provide the mailing address if different from that given in Item 4.

C TYPE OF ORGANIZATION PERFORMING THE WORK

From the following list, select the description that best characterizes the research organization doing this study and circle the two letter code on the form.

IN Private industry	ST Regional, state or local government facility
NP Foundation or laboratory not operated for profit	EG Electric or gas utility
TA *Trade or professional organization*	FF Federally funded R&D centers or laboratory operated for an agency of the U.S. Government
US Federal agency	XX Other (define on questionnaire)
CU College, university, or trade school	

6 SUPPORTING ORGANIZATION

...the DOE Assistant Secretary and office sponsoring the work, the technical representative (including phone number) who directly monitors the ...ected work, his address if different from DOE Headquarters, and the specific person administering the grant or contract.

7 PROJECT SCHEDULE

...current activity is a continuation of a previous project, the start date should indicate the initiation of the prior work. The expected completion date ...should also be entered. If the project is a continuing activity with no set completion date, enter N/A for not applicable.

8 FUNDING

Provide funding in DOLLARS. If funding is received from more than one organization, list each agency separately in the space provided. Funding should ...ate budget obligations (funding level) per year. For example, if budget obligation is $20,000 for 2 years, state the funding level as $10,000 per year. ...Appropriate fill-in parts D, E, F, or G. Use of this Section is optional on Federal Financial Assistance Programs (grants, direct payments, ...perative agreements, loan guarantees, and other related programs).

9 SUMMARY OF WORK

Enter a Project Summary (limit 200 words) covering the following:

...ectives. State project objectives, quantifying where possible (e.g., Demonstrate 95% recovery of sulphur from raw gas with molten salt recycling at a rate ...one gallon per minute.)

Approach. Describe the technical approach to the project (i.e., how the work is to be done).

Expected Product Results. Describe the final products or results expected from the project and their importance and relevance.

10. PUBLICATIONS AVAILABLE TO THE PUBLIC

List publications available to the public that have resulted directly from this project. List only the publications for the last 12 months. Give author(s), title, journal reference or report number, and source from which report or publication may be secured if different from a[illegible]or (e.g., GPO, NTIS, TIC, etc.).

11. GENERAL TECHNOLOGY CATEGORY

Enter the letter and number for the general technology category supported by your project as shown below. Multiple numbers may be entered when the project supports more than one category.

The Multi-Technology category (Item F1) should be used only if your project has a pervasive application or influence on all, or nearly all, technology areas. Examples: R&D on instrumentation, materials research, meteorological research.

The General Science category (Item F2) should be used only if your project, or some portion of it, is basic in nature and not directly related to any specific energy technology.

Insert one or more of the following category codes:

Fossil Fuels (including synfuel)	Geothermal	Conservation
A1 Fossil Fuels (general)	C1 – Geothermal (general)	E1 – Conservation (general)
A2 Coal Conversion – Liquefaction	C2 – Hydrothermal	E2 – End Use
A3 Coal Conversion – Gasification	C3 – Geopressurized	E3 Improved Conversion Efficiency
A4 Oil and Gas	C4 – Hot Dry Rock	E4 – Energy Storage
A5 Oil Shale		
A6 Biomass Pyrolysis		
Nuclear	**Solar**	**Other**
B1 Nuclear (general)	D1 – Solar (general)	F1 Multi-Technology
B2 Fission Converters	D2 – Direct Heat/Cool	F2 General (or Basic) Science
B3 Fission – Breeders	D3 – Electric	F3 Medical Application of Nuclear Technology
B4 Fusion Magnetic	D4 – Ocean, Wind	F4 Hydroelectric
B5 Fusion Laser	D5 – Biomass	F5 – Other (identify on the form)

12. TYPE OF RESEARCH ACTIVITY

Check the types of research activity that are most applicable to this project.

13. KEYWORDS

List the five terms describing the technical aspects of the project. List specific chemicals and CAS number, if applicable.

14. ANALYTICAL/PAPER STUDY

Identify this project as being a paper or non-experimental study.

15. RESPONDENT

Name and address of person filling out the questionnaire. Give telephone number, including extension (if you have FTS number, please include it) at which person can be reached. Record the date the form was completed. The information in Item 15 will not be published.

APPENDIX B

U.S. DEPARTMENT OF ENERGY

REPORTING REQUIREMENTS CHECKLIST

FORM DOE 537 (Revised 10/80)

(See Instructions on Reverse)

FORM APPROVED OMB NO. 38R-0188

1. IDENTIFICATION:	2. OBLIGATION INSTRUMENT:
Energistic Pilot Unit	AC01-81FE13409

3. REPORTING REQUIREMENTS:

A. PROJECT MANAGEMENT:	Frequency	B. TECHNICAL INFORMATION REPORTING:	Frequency
1. ☒ Management Plan	O,Y	1. ☒ Notice of Energy RD&D Project	O,Y
2. ☐ Milestone Schedule & Status Report		2. ☒ Technical Progress Report	Y
3. ☐ Cost Plan		3. ☐ Topical Report	
4. ☐ Manpower Plan		4. ☒ Final Technical Report	F
5. ☐ Contract Management Summary Report		C. COST/SCHEDULE CONTROL SYSTEM CRITERIA REPORTING:	
6. ☒ Project Status Report	Q	1. ☐ Management Control System Description	
7. ☐ Cost Management Report		2. ☐ WBS Dictionary	
8. ☐ Manpower Management Report		A. ☐ Index	
9. ☐ Conference Record		B. ☐ Element Definition	
10. ☒ Hot Line Report	A	3. ☐ Cost Performance Reports	
		A. ☐ Format 1 - WBS	
		B. ☐ Format 2 - Functional	
		C. ☐ Format 3 - Baseline	

FREQUENCY CODES:

A - As Required
C - Contract Change
F - Final (End of Contract)
M - Monthly
O - One Time (After Contract Award)
Q - Quarterly
S - Semi-annually
X - Mandatory for Delivery with Proposal Bid
Y - Yearly or Upon Contract Renewal

4. SPECIAL INSTRUCTIONS:

The contractor is encouraged to publish the results of this work in professional journals. Appropriate reviews must be made. A credit line, similar to the following, must appear with the publication: "Work supported by the U.S. Department of Energy, Assistant Secretary for Fossil Energy, Office of Coal Processing, under contract No. AC01-81FE13409." A reprint copy must be sent to TIC.

5 ATTACHED HEREWITH:

Report Distribution List ☐ WBS/Reporting Category ☐

6 PREPARED BY (Signature and date):	7. REVIEWED BY (Signature and date):

APPENDIX C

DOE F 5120.2
(4-80)

U.S. DEPARTMENT OF ENERGY

FIELD TASK PROPOSAL/AGREEMENT

1 WORK PACKAGE NUMBER	2 TASK NO	3 REV NO	4 PROJECT NO	5 DATE PREPARED	6 CONTRACTOR NUMBER

7 TASK TITLE	8 WORK PACKAGE TITLE

9 BUDGET AND REPORTING CODE	10 TASK TERM (Begin) (End)	11 CONTRACTOR NAME	12 CODE *(see instructions)*

13 CONTRACTOR TASK MANAGER *(Name, Last, First, MI)* (FTS No.)	14 PRINCIPAL INVESTIGATORS *(Name, Last, First, MI)*

15 WORK LOCATION *(See instructions) Name of facility, City, State, Zip Code*	16 Is this task included in the Institutional Plan? ☐ YES ☐ NO	17 Does this task include any management services efforts? ☐ YES ☐ NO

18 TASK DESCRIPTION *(Approach, relation to work package, in 200 words or less)*

19 CONTRACTOR TASK MANAGER

(Signature) *(Date)*

20 DETAIL ATTACHMENTS: *(See instructions)*

☐ a. Facility Requirements	☐ d. Background	☐ g. Future accomplishments	☐ j. Explanation of milestones
☐ b. Publications	☐ e. Approach	☐ h. Relationships to other projects	☐ k. ZBB Detail
☐ c. Purpose	☐ f. Technical progress	☐ i. Environmental assessment	☐ l. Other (Specify)

TASK REQUIREMENTS FOR OPERATING/EQUIPMENT OBLIGATIONS AND COSTS

CONTRACTOR N[illegible]

WORK PACKAGE NUMBER	TASK NO	REV NO	DATE PREPARED	CONTRACTOR NUMBER

21 STAFFING *(in staff years)*	PRIOR YEARS	BY 2	BY 1		AUTHORIZED	BY FY 19
			PRESIDENT'S	REVISED		
a SCIENTIFIC						
b OTHER DIRECT						
c TOTAL DIRECT						
22 OBLIGATIONS AND COSTS *(in Thousands)*						
a TOTAL OBLIGATIONS						
b TOTAL COSTS						
23 EQUIPMENT *(in Thousands)*						
a EQUIPMENT OBLIGATIONS						
b EQUIPMENT COSTS						
24. OTHER COSTS *(specify)*						
a						
b						
c						
d						

25 OPTIONAL FIVE YEAR PLAN *(in Thousands)* Constant BY dollars	BY+1	BY+2	BY+3	BY+4	TOTAL TO COMPLETE
a TOTAL OPERATING OBLIGATIONS					
b. TOTAL OPERATING COSTS					
c TOTAL EQUIPMENT OBLIGATIONS					
d TOTAL EQUIPMENT COSTS					

26 MILESTONE SCHEDULE	PROPOSED SCHEDULE	AUTHORIZED SCHEDULE

DOE F 5120.2
(4-80)

U.S. DEPARTMENT OF ENERGY
FIELD TASK PROPOSAL/AGREEMENT
INSTRUCTIONS

a. General. As negotiated by the work package manager, the two page WPAS Field Task Proposal/Agreement Form is prepared for each of the tasks included in the work package. They may be prepared by the lead contractor when the task is being done by that contractor or by various subcontractors who have been assigned tasks by the lead contractor. Tasks must be limited to a single project to allow reporting of cost, obligation and other information needed by the DOE Program/Project Management System (PPMS). The data items and associated instructions below have been arranged in the sequence in which they appear on the task form.

A copy of the final agreement and detail attachments 20.b. and 20.f. is to be sent annually to the Technical Information Center for incorporation in the Research in Progress file.

b. Page 1 of the Form.

Item 1. Enter the unique seven character number which was assigned to the work package, if any, with which the task is associated. If the task is not associated with a work package, enter the word "None."

Item 2. Enter a unique seven character number for the task. The first two characters of this number are to signify the DOE organizational code used when assigning regular contract numbers, such as ER, EV, and DP. The third character is to be the letter "T". The remaining four characters will be a unique numerical sequence number assigned to the task. Example: ERT0001.

Item 3. If the initial task proposal is changed, a revision is indicated by placing a number in this space, starting with the number 1 and proceeding in sequence. This number will start over at "0" at the beginning of each fiscal year.

Item 4. This space is for future use to associate the task with projects included in the Program/Project Management System.

Item 5. The month, day, and year on which the task form is prepared for submission to Headquarters, for example: 04-01-80.

Item 6. A number which may be assigned by the contractor for internal control.

Item 7. A descriptive title of the task being proposed.

Item 8. The title of the work package, if any, with which the task is associated.

Item 9. The Budget and Reporting Code in accordance with the B&R classification set forth in the Accounting Practices and Procedures Handbook.

Item 10. The start and estimated completion date of the proposed task. Use a two-numerical format for month, day, and year, for example: 10-01-80. For tasks initiated for an indefinite period of time, the completion date should be shown as "OPEN."

Item 11. Enter the name of the contractor organization responsible for the task.

Item 12. When known, the lead contractor should enter a three letter code, as carried on Procurement's Vendor Name File, identifying the contractor organization which will be executing the specific task. If the contractor is not on the file, the number "999" should be entered by the work package manager.

Item 13. The name and FTS phone number of the contractor person responsible for the control and monitoring of the task.

Item 14. The name(s) of the contractor person(s) responsible for the technical progress and achievement on the task.

Item 15. The specific location where the majority of the work is performed, including the facility in which the work is performed, the city, the State, and the zip code. When the task is being performed by the lead contractor responsible for the work package, this information is only entered if the work is performed at a location different than the contractor's main facility. For other contractor's who are performing a task as a subcontractor on the work package, the work location should be completed in all cases.

Item 16. Indicate by a check mark whether the task is included in the most recent Institutional Plan.

Item 17. Indicate by a check mark whether the task includes the furnishing of any management services efforts as defined by DOE Order 1370.1 issued 06-05-78.

Item 18. A description of the task in 200 words or less, highlighting the purpose, the technical approach to be taken, and the relation of the task to the work package.

Item 19. The signature of the contractor representative responsible for the task and the date of submission are to be entered here when the task is submitted as an implementation plan for approval for execution.

Item 20. The detail attachments described below are to be completed if they are necessary to understanding or will enhance the task proposal. Any attachments accompanying the form should be indicated by checking the appropriate blocks of the form. Each attachment page should include the contractor name, work package number, task number, any revision number, the date prepared, and the contractor number. The DOE work package manager may specifically request the completion of any or all of the attachments.

a. Facility Requirements. If execution of the WPAS work package or task proposal requires the use of existing or approved proposed facilities, briefly describe the required use, and location, with associated gross square footage and impact on site utility services by fiscal year in which the task begins and each subsequent fiscal year during the anticipated life of the WPAS task. Facility needs will be viewed in context of overall site planning and utilization and expressed in terms of space function, e.g., office, storage space, site utilities, roads, etc.

b. Publications. List all publications pertaining to the task that have been issued or presented during the prior fiscal year. Provide the title or subject and planned date of publication of all topical reports, over the life of the task. Periodic progress reports are to be listed in this section.

c. Purpose. Provide the reason(s) for the task and the objectives that will accomplish the stated purpose. The objective(s) should be the single highest level of measurable achievement that can serve as a criterion for assessing the success or failure of the task.

d. Background. Present a brief, historical overview of the task or previous work or theories that have led to the task.

e. Approach. Explain the management controls and R&D methodology that will be employed to execute the task in all fiscal years.

f. Technical Progress. Attach the last Technical Progress Report if required by the DOE program. Also, describe the technical progress in BY-3 (the last complete fiscal year) and expected progress by year for BY-2, BY-1, and BY.

g. Future Accomplishments. Describe any anticipated benefits that will accrue in the future which are attributable to the task.

DOE F 5120.2
(4-80)

h. Relationships to Other Projects. Provide a description of any relationships, interrelationships or dependencies which the task has with other known Federally funded projects or areas of work.

i. Environmental Assessment. In accordance with the National Environmental Policy Act of 1969, describe the long-term and short term potential impacts and effects of the task upon the ecosystem.

j. Explanation of Milestones (if applicable). A detailed explanation of the milestones presented on the second page of the task proposal (item 26) should be given. For basic research, the only milestone may be the submission of a yearly progress report.

k. ZBB Detail. Attach zero-based budgeting information in the format specified by the program for those programs requiring this input.

l. Other. Any other attachments should be specified in the space provided on the task form.

c. Page 2 of the Form - General. Header information on this page should be filled in as it appears on page 1. For the BY 1 column, manpower and dollar information must be consistent with program guidance when entered in the "President's" column. A revised request may be submitted under the "Revised" column BY 1. The "Authorized" column is not completed unless requested by the program when the work package is approved and funds have been authorized.

The fiscal year column heading designations on page 2 of the WPAS task form are defined below. The relationship between the years is illustrated in the table below:

Prior Years. For tasks related to projects, information for all prior years in which work has been performed must be provided to allow total project cost and other information to be calculated. This column is optional and should only be completed when requested by the program in the program guidance.

BY 2 (Past Year). The fiscal year immediately preceding the current year.

BY-1 (Current Year). The fiscal year immediately preceding the budget year.

BY (Budget Year). The fiscal year for which estimates are to be presented to Congress.

CALENDAR YEAR THAT DOE PREPARED BUDGET (BY)

	1978	1979	1980	1981
BY 2	FY 1978	FY 1979	FY 1980	FY 1981
BY 1	FY 1979	FY 1980	FY 1981	FY 1982
BY	FY 1980	FY 1981	FY 1982	FY 1983

	1979	1980	1981	1982

CALENDAR YEAR THAT CONGRESS CONSIDERS BUDGET (BY)

Item 21. Designate figures for personnel staffing in full time equivalent person years (as defined in DOE Manual Chapter 1101). Enter the number for scientific and other direct person-years for each column.

Item 22. Enter the estimates for total obligations and total costs per year. This should include any inventories.

Item 23. Enter the total estimated obligations and costs of equipment directly related to the task per year.

Item 24. Other Costs. Space is provided for any other costs required by the work package manager.

Item 25. When requested by the work package manager, estimate the total operating (including inventories) and equipment obligations and costs for four additional years, based on constant (not inflated) dollars for the budget year and guidance provided by the DOE program. For tasks which support DOE projects and have a scheduled end date, the totals to complete the task for all years beyond the estimates given for the four additional years should be provided.

Item 26. Key significant milestones/product deliverables necessary for completion of the task should be entered in the "Milestone Schedule" column. The dates (month and year) on which milestones/ deliverables are projected for start and completion should be entered under the "Proposed Schedule" column. The "Authorized Schedule" column will be completed, if requested by the work package manager when funds have been authorized. Based on the allocation of funds, enter the dates for the planned start and completion of the respective milestones/deliverables when requested.

SAMPLE

STATUS FILE

Showing Reporting Requirements (By Code)

and

Required Reports That Have NOT Been Received by TIC

EY-76-C-02-0038		CH9	NOTRE DAME UNIV OF	10	02/01/49	MULTIPROGRAM RADIATION LABORATORY PRIMARILY
$1801922		AK	NOTRE DAME IN	3	12/31/78	INVOLVED IN RADIATION CHEMISTRY STUDIES
$25700583		ER	MRMRRMRRRRRRRRRRRR	C	AK01 OT	
		QT1--76	QT3--76 QT4--76			
EY-76-C-02-0058		CH9	COMBUSTION ENGINEERING	10	06/25/75	DESIGN-SIMULATION TESTING AND FABRICATION OF A
		BD	BRUCETON PA	3	04/30/78	SYSTEM TO DISCHARGE DRY CHAR FROM BRUCETON
$1009786		ET	MR NONE	P	AA03 OT	SYNTHANE PILOT PLANT GASIFIER
		FINAL(1)	DEC--77 FEB--78 MAR--78			
EY-76-C-02-0578		CH9	I I T RESEARCH INSTITUTE	10	01/15/60	MASTER CONTRACT-CONDUCT RESEARCH RELATING TO
		AK	CHICAGO IL	3	12/31/99	ATOMIC ENERGY AS DEFINED FROM TIME TO TIME IN
		US	MSJMSJMSJMSJMSJEGI	N	AD01 OT	SEPARATE PROJECT AGREEMENTS AND TASK ORDERS
		QT1--76	QT2--76 QT3--76 QT4--76	QT1--77	QT2--77	QT3--77 QT4--77 QT1--78
		QT2--78				
EY-76-C-02-2331		CH9	MINNESOTA MINING AND MFG	10	01/02/68	CREATE HIGH EFFICIENCY THERMOELECTRIC COUPLE
$1766453		BQ	ST PAUL MN	3	09/30/78	FORMERLY AT-29-2-2473 TRSF TO CH
$7170133		ET	MREFHAMPL	P	35AG OT	
		QT1--76	QT2--76 QT3--76 QT4--76	JAN--76	FEB--76	MAR--76 APR--76 MAY--76
		JUN--76	JUL--76 QT1--77 QT2--77	QT3--77	QT4--77	JAN--77 MAR--77 APR--77
		MAY--77	JUN--77 JUL--77 AUG--77	SEP--77	OCT--77	NOV--77 DEC--77 QT1--78
		QT2--78	JAN--78 FEB--78 MAR--78	APR--78	MAY--78	JUN--78 JUL--78
EY-76-C-02-2426	001	CH9	COMBUSTION ENGINEERING	10	03/01/74	STUDY OF PROOF TESTING OF LMFBR CARBIDE FUEL
$210000		BQ	WINDSOR CT	3	12/31/78	ASSEMBLIES IN THE FTR DRIVER POSITIONS
$1254770		ET	MSS CASPERSSON	P	AG03 OT	
		QT1--76	QT3--76 QT4--76 JAN--76	FEB--76	MAR--76	APR--76 MAY--76 JUN--76
		AUG--76	SEP--76 DEC--76 QT1--77	QT3--77	FEB--77	APR--77 MAY--77 JUN--77
		JUL--77	AUG--77 SEP--77 OCT--77	NOV--77	QT1--78	JAN--78 APR--78 MAY--78
		JUN--78				
EY-76-C-02-2566		CH9	FORD MOTOR CO	10	06/15/75	B--ALUMINA, SODIUM-SULFUR BATTERY DEVELOPMENT
$3600000		BQ	DEARBORN MI	3	01/30/79	
$7433267		ET	MRA TOPOUZIAN	P	C801 OT	
		QT1--76	QT2--76 QT3--76 QT4--76	MAR--76	JUL--76	AUG--76 SEP--76 QT2-77
		QT3--77	AUG--77 QT2--78 JUL--78			

APPENDIX E

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.
.
.R RNBNCN


WELCOME . . .
to the Technical Information Center's Reports Holdings File, "TIC's RHF"
                    . . . . .PLEASE. . . . .
             follow directions on your screen carefully
                  TYPE "X" any time for an EXIT

             OPTION     SEARCH ELEMENT
             ======     ==============
               F        FORMAT of Reports Holdings File
               H        H E L P
               1        Last seven digits of Contract No.
               2        DE number (accession number, Bar-Code number)
               3        Report Number
               4        PARTIAL search - please be patient !
               X        EXIT from this program


TYPE OPTION .... 1

TYPE Magic-7 last digits of Contract No... ET41900

CONTRACT NUMBERS FOUND=     1

CURRENT CN= AC09-79ET41900

Would you like to see full contract information  ?  (Y or N):  Y

AC09-79ET41900                                      REP REQMTS: AK
CONTRACTOR: ROCKWELL INTERNATIONAL                  PATENT OF : SR
            AL ENERGY SYSTEMS GRO                   AWARD TYPE: U
            CANOGA PARK          CA 91304           AWARD DATE:  9/13/1979
AWARD ADM : R. D. SIMPSON                           AWARD AMT :    3462082
TECH REP  : W. B. WILSON                            COMP DATE :  9/30/1981
SR INVEST : DR. A. MARTIN                           CLOSE OUT : 12/81
PROJ MGR  : T. B. HINDMAN
TITLE     : DEVELOPMENT OF TAILORED CRYSTALLINE CERAMICS FOR GEOLOGIC
STORAGE OF RADIOACTIVE WASTE


        Above is the full Contract information

Would you like to see all reports in our "holdings" file ? (Y or N): Y


SEARCHING.......


   18  REPORT(s) FOUND under Contract Number: AC09-79ET41900

REPNO: DOE/ET/41900--1                              REPPC: T/00/80
DENO : DE           REPDT: 04/80    SOURC: NTIS PC A02/MF A01

REPNO: DOE/ET/41900--10                             REPPC: T/04/82
DENO : DE82020264   REPDT: 04/82    SOURC: NTIS PC A02/MF A01

REPNO: DOE/ET/41900--12                             REPPC: T/09/81
DENO : DE82012506   REPDT: 09/81    SOURC: NTIS PC A04/MF A01

REPNO: DOE/ET/41900--13                             REPPC: T/03/82
DENO : DE82013288   REPDT: 03/82    SOURC: NTIS PC A03/MF A01

REPNO: DOE/ET/41900--14                             REPPC: T/03/82
DENO : DE82013246   REPDT: 03/82    SOURC: NTIS PC A02/MF A01

REPNO: DOE/ET/41900--16                             REPPC: T/02/82
DENO : DE83007885   REPDT: 02/83    SOURC: NTIS PC A04/MF A01

REPNO: DOE/ET/41900--17                             REPPC: T/02/83
DENO : DE83006235   REPDT: 02/83    SOURC: NTIS PC A07/MF A01
```

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TYPE "M" to continue, OPTION NUMBER for next search,
or REPORT NUMBER for FULL format...  M

REPNO: DOE/ET/41900--18                              REPPC: T/02/83
DENO : DE83007892   REPDT: 02/83    SOURC: NTIS PC A06/MF A01

REPNO: DOE/ET/41900--2                               REPPC: T/00/80
DENO : DE81011139   REPDT: 12/80    SOURC: NTIS PC A03/MF A01

REPNO: DOE/ET/41900--3                               REPPC: T/00/81
DENO : DE81013031   REPDT: 02/81    SOURC: NTIS PC A03/MF A01

REPNO: DOE/ET/41900--4                               REPPC: T/00/81
DENO : DE81015979   REPDT: 03/81    SOURC: NTIS PC A03/MF A01

REPNO: DOE/ET/41900--5                               REPPC: T/00/81
DENO : DE81030154   REPDT: 08/81    SOURC: NTIS PC A03/MF A01

REPNO: DOE/ET/41900--6                               REPPC: T/00/81
DENO : DE81030153   REPDT: 08/81    SOURC: NTIS PC A05/MF A01

REPNO: DOE/ET/41900--7                               REPPC: T/00/81
DENO : DE81028554   REPDT: 06/81    SOURC: NTIS PC A03/MF A01

TYPE "M" to continue, OPTION NUMBER for next search,
or REPORT NUMBER for FULL format...  M


REPNO: DOE/ET/41900--8                               REPPC: T/00/81
DENO : DE81028502   REPDT: 07/81    SOURC: NTIS PC A04/MF A01

REPNO: DOE/ET/41900--9                               REPPC: T/00/81
DENO : DE81026067   REPDT: 07/81    SOURC: NTIS PC A03/MF A01

REPNO: DOE/ET/41900--T1                              REPPC: Q/4Q/79
DENO : DE           REPDT: 02/80    SOURC: NTIS PC A02/MF A01

REPNO: DOE/ET/41900--T2                              REPPC: Q/1Q/80
DENO : DE           REPDT: 05/80    SOURC: NTIS PC A03/MF A01

TYPE "M" to continue, OPTION NUMBER for next search,
or REPORT NUMBER for FULL format...  DOE/ET/41900--16

1. REPNO: DOE/ET/41900--16              8. REPDT: 02/83
2. CNTR : AC09-79ET41900                9. REPPC: T/02/83
3. DENO : DE83007885                   10. SOURC: NTIS PC A04/MF A01
4. ENTDT:  3-14-1983                   11. DSTCD: 24
5. CLASS: U                            12. AVLCD: 1
6. CATNO: 70                           13. COPRE:    323
7. ANNCM: ERA;EDB;INIS                 14. DRWNO: 1233


TYPE "R" to return to menu, or option NUMBER for next search.... 4

TYPE "DE" for partial DE number, "RN" for partial report number... RN

TYPE partial report number... DOETIC7000

     3: RNs found that begin with: DOETIC7000

SORTING.......

REPNO: DOE/TIC--7000 Rev 4                           REPPC: X/10/79
DENO : DE           REPDT: 10/79    SOURC: NTIS N/P

REPNO: DOE/TIC--7000-R5                              REPPC: X/03/81
DENO : DE81012130   REPDT: 03/81    SOURC: NTIS PC A99/MF A01

REPNO: DOE/TIC--7000-R5 App.                         REPPC: X/00/81
DENO : DE82005770   REPDT: 10/81    SOURC: NTIS PC A11/MF A01

TYPE "M" to continue, OPTION NUMBER for next search,
or REPORT NUMBER for FULL format... F

TYPE "R" to return to menu, or option NUMBER for next search.... F

TYPE "R" to return to menu, or option NUMBER for next search.... X
```

YOUR SUGGESTIONS AND COMMENTS ARE WELCOME

PLEASE CONTACT MICKEY MOORE, DATA PROCESSING DIV. AT TIC - FTS 626-1138

PLEASE TYPE "K/F" AND A CARRIAGE RETURN

BEFORE YOU DISCONNECT YOUR PHONE LINE TO TIC !!!

END OF EXECUTION
CPU TIME: 1.61 ELAPSED TIME: 3:46.80
EXIT

Computer-based conferencing

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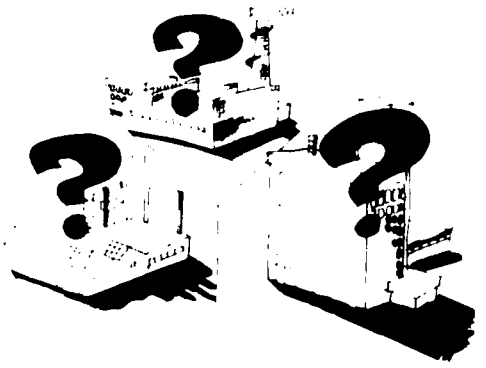
Abstract: Computer conferencing is a more powerful communication medium than electronic mail. The important difference is that computer conferencing provides structuring facilities on the data base of text documents, by putting text items into conferences and sub-discussings within a conference. This structuring will be essential to allow users to control and order the large information flow which will occur in the future.

Computerized conferencing will probably start to play a major role in the eighties in furthering regional and international cooperation.



A computerized teleconferencing system can be seen as something halfway between a conference and a very rapidly published newsletter. The system can be used by hundreds of people at diverse geographical locations. Each user must have access to a simple computer terminal; a typical user sits at this terminal once or twice a day.

The system has a data base, consisting of a large number of text messages. Each such text message can contain any text written in ordinary human language which the author wants to put there. There are two main kinds of messages: the first, called a letter, is a message from one user to a single or a number of other users. The second type, called a conference entry is stored in one of several computerized conferences. A number of users are members of the computerized conference. Each member normally reads all that is written in the conference and also can freely write messages into the conference, which are then made available to all the other members of the conference.

The computer remembers which messages each user has already seen. When users connect to the system, they will get all their new letters and all the new entries in the conferences they are members of. They can directly write their own messages, which will then immediately be stored in the database.

It is important to note that rarely do all members of a computerized conference sit at their terminal at the same time, conducting an ordinary meeting but with written instead of vocal communication. Instead, a typical user connects once or twice a day at times suitable to this user, gets all news and writes any comments or new messages into the system. Thus, the system is in a way more similar to a very rapidly published newsletter than to a conference.

Some advantages with computer conferencing

- You can take part in many on-going conferences using much less time than for face-to-face meetings.
- You can read and write at times suitable to yourself, when you have free time, or something to say or to ask for.

- Communication can go on every day over several months or years, which means that you must not wait for the next scheduled meeting to take up a problem. This also means that you can, if you wish, wait a day or two with a reply to look up facts or consider the matter.

- You can skip messages of less interest and use the computer to help you select or search for what you want to read.

- You can get a large group of people to look at a proposal or a question and get their comments within a day or two.

- Because you save the time and cost of travel much more intense and close cooperation is possible across geographical distances. Because everyone can connect at a time of their own choice, communication across time zones is made more easy.

- People with different mother tongues often find it easier to understand each other by written than by spoken language.

- Computerized conferencing seems to work well in groups of fifty or a hundred participants, while it is well known that face-to-face meetings can be cumbersome with more than about seven participants.

Computerized conferencing should not be seen as a replacement for all face-to-face meetings, since experience with existing systems shows that most of the communication is of a new kind which would not have taken place at all if this tool had not been available. There are of course certain tasks, for example those including complex negotiations, where the fast and immediate interaction of face-to-face meetings is essential.

Examples of computerized teleconferences:

- Exchange of experience between people with similar tasks but placed in different locations, for example exchange of experience between users of a common computer system or application including contacts with the developers and maintainers of the software.

- Collection of comments and ideas on suggestions and proposals from a geographically distributed group of people; for example, obtaining comments on a proposed change in the characteristics of a product from its users.

- Contacts in groups working toward a common goal but spread at different locations, for example, the members of a standards committee.

- Getting answers to questions by posing them to a group of people well-informed in the subject area of the question, for example, how to find a product with particular desired characteristics.

- Contacts between sales offices in many different countries and the main office. Computer conferencing is usually much cheaper than telex.

Computer Conferencing is more than Electronic Mail

All good computer conferencing systems are also good electronic mail systems. But computer conferencing systems provide something more:

- The receivers of information have better facilities for controlling the communication process and avoid the problems with information overload which occur with all large electronic mail systems.

- Computer conferencing helps to establish communication between people who are distant geographically or organizationally. Sociological studies show that such people are more successful.

Computer conferencing gives a communication which is both very fast and efficient and also psychologically well suited to communication even in larger groups than are suitable for face-to-face meetings.

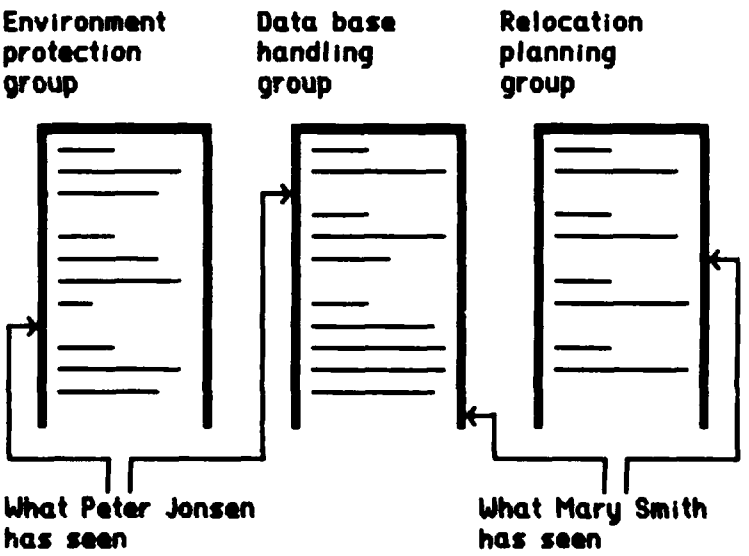
Functional differences between computer conferencing and electronic mail

Both electronic mail and computer conferencing is based on humans entering messages from computer terminals. Similar to both systems is also that the people communicating are rarely using the system at the same moment of time. This is an important difference from face-to-face meetings, where everyone has to meet at the same time.

In a pure electronic mail system, the sender of a messages enters from his/her terminal the names of those who are to receive the message. This facility is also present in computer conferencing systems. But messages in computer conferencing systems can also be sent to conferences. Messages sent to a conference are made available to (but not forced upon) all members of the conference. Conferences can be open (public) which means that anyone interested in the subject of the conference can join, or they can be closed, which means that the organizers of the conference decide who can take part in the conference.

Users of a computer conference system connect regularly, e.g. once a day to the system. They then read new letters to them and new messages in the conferences in which they participate.

For every user who is a member of a conference, the system keeps a counter of how far this user has read in the list of messages in this conference. The user is shown only new messages when connecting to the system. Users can however review old messages if they wish to do so.

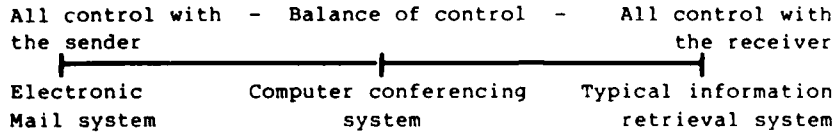


This figure shows the main principles of the news control facility in a computer conference system. In the figure, Peter Jonsen is a member of the first and second conference, and Mary Smith is a member of the second and third conference. There is a pointer in the data base for each person and each conference of which this person is a member. This pointer shows how far that person has read. Thus, users can enter the system at different times, and the system can show each user what is new to that user. If a user has been away for a few days, s/he will not miss anything. The number of entries below the marker will simply be larger than if a user connects more often.

Distribution of control

There are at least three parties involved in a communication process: The sender of a message, the receiver of a message and the organization using the communication system. More control for one of these three parties may mean less control for the other parties. A good computer conference system tries to achieve a balance of control between them. There is reason to believe that this will give a better communication process than a system where the communication process is too much controlled by one of the parties.

In a system where the communication process is too much controlled by the sender of the information, problems with information overload will for example often occur. This is the case with most electronic mail systems, where the sender of a message has almost all the control, deciding which people are to read the message sent.



This balance of control is achieved in the following way:

The sender of a message in a conference system can tell the system the names of one or more people who are to receive a message. In this case, the sender has full control of the receiver list. The receivers can send the message along to other people, but this is still a control from the sender, since the receiver now acts as a new sender.

92 % of all messages read in the COM computer conference system are however conference notices, not personally addressed letters. In this case, control is distributed between the sender, the receiver and the organizer. The sender decides to which conferences the message is sent. The organizer can remove messages from a conference which do not belong to the subject of the conference. For open conferences, the receiver decides which conferences to join. For closed meetings, the organizer decides who are allowed to participate, but a conference participant can always withdraw from a closed conference. The receiver decides the priority, in which different conferences are to e read.

More communication between distant people

This table shows how much of the communication in a large research institute using the COM computer conference system which went between people who were close and distant in the organization.

	Using the mail facility	Using the conference facility
Communication between people within one department	77 %	38 %
Communicatin between people in different departments	23 %	62 %

These result shows that there is a difference between who communicates with whom using the mail and the conference facility in the system. The mail facility gives more communication between people who are close geographically or organizationally and who know each other well. The conference facility gives more communication between people who are far away and do not know each other. Th reason for this is that the sender of a conference entry need not know the names of all the people who are to receive the entry.

This is important because sociological studies show that people who have many contacts at larger organizational and geographical distances are more successful. They tend to be less conservative, they will easier accept new ideas and they are less prone to get stuck with bad or suboptimal solutions to their problems.

Larger groups work better

The figure below shows an important difference between computer conferencing and ordinary face-to-face meetings. The figure illustrates a group of 12 people communicating.

Conference system: Longer writing time but shorter reading time

Writing	Reading	Total time
3.6 min.	11 times 0.47 = 5.2 minutes.	3.6 + 5.2 = 11.2 minutes.

Ordinary meeting: You talk faster than you write, but you listen slower than you read:

Total time for talking and listening: 12 times 1.7 = 20.4 minutes.

Communication through a computer conference system is thus more efficient with time. If the time and cost of travel is included, the conference system is of course even more efficient. Studies on the COM computer conference system shows that if the same communication which takes place in COM would be performed through face-to-face meetings, the cost would be more than ten times larger. This estimate includes both travel costs, computer system costs and the value of the time of the people who use the system.

The reason why the reading time is shorter in the conference system is not only because people read faster than they listen, but also because a conference system allows every participant to decide how much time to spend on each message. You can read carefully items of importance and skip items with information you already know or which is of no interest to you.

This difference is not only an efficiency factor. It is also important psychologically. With twelve participants, as in the example above, every person uses about a third of his/her time giving information and about two thirds of the time receiving information, in the computer conference system. In an ordinary face-to-face meeting, they would on average talk 8 % of the time and listen 92 % of the time. Communication works psychologically better with computer conferencing, because you are not forced to be a passive listener as much as in face-to-face meetings. This also means that computer conferences can work well even in group sizes of 30-100 people which would be very difficult to manage in face-to-face meetings.

The marginal cost of letting one person more take part in the communication is much lower with computer conferencing than with face-to-face meetings. This makes it economically possible to have larger group sizes, which means that more people can contribute with ideas and thus improves the quality of the result.

Distribution lists

Some electronic mail systems have distribution lists. You can send a message to a distribution list, and it will then be sent to all people on the distribution list. Note that this is not at all the same thing as computer conferencing. Much use of such distribution lists will cause severe information overload problems, while computer conference systems provide a way of solving this problem. The importance with computer conferencing is not only that messages can be sent to a group of people, but also that the receivers can decide which conference to take part in, and in which order to read news in different conferences.

The COM and PORTACOM systems

COM and PORTACOM™ are two functionally similar computer conferencing systems. Basic principles of COM and PORTACOM is to base the systems on a very general-purpose basic data base structure. On top of this general-purpose data base structure is built a user interface which is designed to be both very easy to use for the beginner and very powerful for the advanced user at the same time.

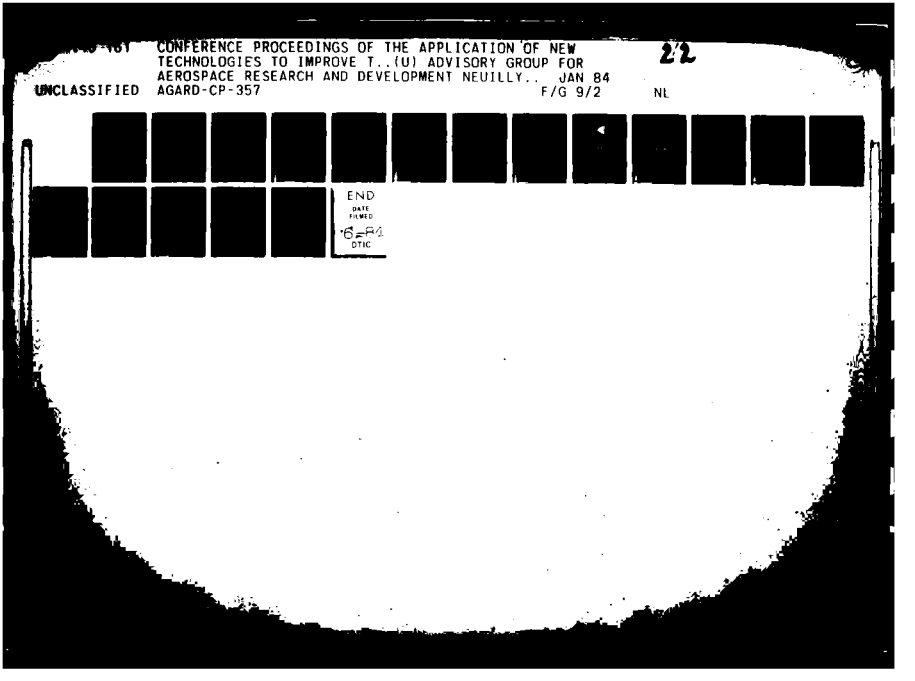
The data base consists of one area storing entry texts, one area storing users and conferences, and one area storing links between the texts, users and conferences. A text can be sent to any number of users or conferences by establishing links between the text and the receivers, a user can become a member of a conference by establishing a link between the user and the conference.

The user interface uses a combination of menus and commands. Novice users are guided by menus, but any command to the system can actually be given at any menu, and the menu alternatives are actually only a selection of the system commands. In this way, the system is easy to use for beginners because of the menus, but powerful for the advanced users since any command can be given at any time.

Where is COM used?

At QZ, we have two large COM systems running, one with a Swedish-language and one with an English-language data base. The Swedish-language system has when this is written (April 1983) about 1000 users taking part in about 300 active conferences. The English-language system has about 400 active users from more than 10 countries on three continents. The international user take part in about 60 active conferences. COM and PORTACOM systems are also installed at about 20 other computer sites in Europe and America.

COM was originally developed for the DECsystem-10 and DECsystem-20 computers. PORTACOM is a portable version of COM, written in Pascal, and its development is financed jointly by nine European countries. PORTACOM will be available on the following computer models: Norsk Data Nord-100, Digital Vax-11/VMS, IBM/370, Univac 1100, Burroughs 7800, Siemens B-2000 and Control Data Cyber. Implementations on 32- bit micros are also planned.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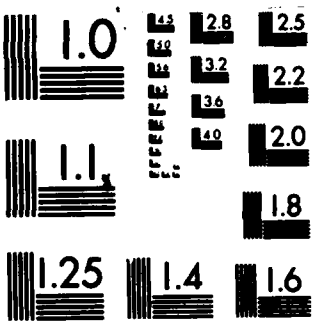

The GILT project

The GILT project is a joint European project to develop a standard for the interconnection of computer-based message systems. Most other standards for the interconnection of computer-based message systems are only designed for interconnecting mail systems, and usually only provide two functions, a SEND-MAIL and a NAME-SERVER function. GILT is designed for the interconnection of both mail and conference systems. In addition the the above fuctions, GILT will define many more functions, for example the establishment of a parallel conference at several computer sites with automatic exchange of messages and the facility for one system to read messages from the data base of another system.

References

FOA reports below can be ordered from Rapportcentralen, FOA 1, Box 27322, S-102 54 Stockholm, Sweden.

Information about the availability of the COM and PORTACOM computer conference systems can be obtained from the QZ Computer Centre, Box 27322, S-102 54 Stockholm, Sweden, phone +46-8-67 92 80. In North America, information is also available from Paul Heller at Edunet, P.O. Box 364, Princeton, New Jersey 08540, phone (609) 734-1915. The systems are available both for installation on your own computer and for use through international computer networks (EURONET, DATEX-P, TELENET, TYMNET etc.) links to QZ in Sweden.

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AUTOMATED DOCUMENT REQUEST AND DELIVERY SYSTEMS IN THE UNITED KINGDOM

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SUMMARY

There are already in use in the UK a variety of methods for the telecommunication of requests: through direct terminal-to-computer and computer-to-computer links or via information retrieval database systems. These are described with particular reference to the British Library Lending Division's Automated Request Transmission (ART) services. Possible extensions of these services are also outlined. A rapid document delivery service based on facsimile transmission between British Library sites has been in operation for some time, and the results of a pilot service to international users employing more advanced equipment are reported. The increasing provision of satellite links and developments in digital optical recording (DOR) discs and electronic publishing are stimulating the planning of more revolutionary electronic document delivery systems. Factors affecting the provision of such services are discussed as a prelude to a review of a number of UK and European initiatives.

1. INTRODUCTION

Papers presented at past AGARD TIP symposia, and in particular those of Lancaster(1) and Hampel(2) have identified the technological developments that will stimulate radical changes in the patterns of information transfer. This paper is intended to serve as a progress report on the realization of elements of the new information chain by using as examples automated document request and delivery systems in the UK.

The highly centralized nature of the interlending system in the UK inevitably means that particular reference must be made to the British Library Lending Division. It is hoped the Division needs little introduction. Its loan/photocopy services have been described by Norton(3) at a previous AGARD TIP symposium. Its comprehensive collection of serials covering research activity across the world, its English language monograph acquisition programme and its enormous stock of unclassified report literature enable it to satisfy a very high proportion of its users' needs worldwide. The defence and aerospace community is a valued and important sector of its user base. Concentrating on the UK and the Lending Division will not unnecessarily restrict the scope of the paper. The increasingly international dimension of information transfer means that European and North American initiatives will also be drawn in as they impinge upon the UK.

One of the major advantages of electronic document delivery is speed, and obtaining documents speedily requires not only rapid delivery but the rapid transmission of requests. A description of the Lending Division's Automated Request Transmission (ART) services together with possible future developments therefore precedes a discussion of the factors affecting electronic document delivery and an overview of some current initiatives in this field. But between these two main topics the application of an older but still developing technology, facsimile transmission, is presented.

2. AUTOMATED REQUEST TRANSMISSION

Requests transmitted by means other than mail now account for nearly a quarter of all requests received by the Lending Division. These requests come via:

- Telex
- DOCLINE
- Database services
  - DIALOG — DIALORDER
  - SDC ORBIT — ORBDOC
  - ESA-IRS — PRIMORDIAL
  - BLAISELINE — ADRS
- ARTTel
  - Over telephone networks
  - Over packet switched networks

Figure 1 shows the relative proportions of these for the 1982/3 financial year. Telex still accounts for the largest number of requests, but a rapidly increasing proportion are now being received via database services and ARTTel. The handling of Telex requests by the Lending Division has been computerized since the mid-1970s, but, since the system also forms the basis for the ARTTel service, it is best described in that context.

DOCLINE was developed during the first half of the last decade to take requests from agents in overseas countries. Under this system users' requests are stored on the agent's computer in a ready-to-print format, and at daily intervals Lending Division staff dial up the computer from a printer terminal. Requests are printed directly onto continuous stationery photocopy forms similar to the normal postal forms to which the Lending Division document retrieval processes are geared. Organizations using this method of request transmission are the National Library of Medicine and Centre for Research Libraries in the USA and Chalmers University of Technology in Sweden, all of which act for groups of libraries.

Requesting via database services has shown a very rapid growth over the past year, as links have been established with the major systems. It can be expected to rise still faster when, it is hoped, the facility can be offered in the UK. This is anticipated in 1984 when a deposit accounting system similar to that provided for overseas users can be introduced to operate in parallel with the prepaid form accounting which has been the mainstay of interlending in the UK for the last two decades. Users of services such as DIALOG find it particularly convenient to be able to turn references retrieved from database searches into document requests without having to rekey the citations. This is shown schematically in Figure 2. Requests not retrieved from databases can also be keyed in, but, if there are large numbers of such requests, then it should be more economic to use ARTTel.

In this context it is interesting to note that a survey (4) conducted in 1982 showed that for only 11% of all requests on the Lending Division was the source of reference an information retrieval database system. Even conventional abstracting and indexing publications, though the largest single category, still accounted for only 26%. Citations in journal articles or books (25% and 19% respectively) were the other main sources reported. While there is clearly potential for considerable growth in the use of database services and probably in associated automated document requesting as well, it is obvious that there will have to be continuing provision for direct requesting services such as ARTTel.

Since its launch as a pilot scheme in the Autumn of 1981 ARTTel has shown remarkable growth, despite the fact that until now it has only been available over the telephone network. By dialling up the ART minicomputer a user can transmit requests from his terminal, microcomputer, minicomputer or mainframe. Two modes of transmission are supported: interactive for terminal-to-computer link, and block mode transmission of files of requests stored, say, on the user's microcomputer. Figure 3 is a schematic diagram of ARTTel. Requests are sent in a predefined format in which the bibliographic citation must conform to a maximum of 11 lines of 40 characters each to allow it to be printed onto a continuous stationery form resembling the Lending Division postal form. The despatch address is extracted from the address database on the ART minicomputer which controls the format checking and printing of requests as well as the incoming lines.

The growth of this service is probably due to two factors: the increasing availability of terminals and microcumputers in libraries, and the fact that even over the telephone network the transmission costs can be cheaper than Telex. Some calculations done in 1982 showed that the transmission cost per request could be reduced by a factor of three over Telex. The ARTTel service is expected to really accelerate in growth when, before the end of the year the ART minicomputer is connected to the UK Packet Switched Service (and thence to packet switched networks across the world). Then transmission costs per request will fall by an order of magnitude over Telex. Further advantages will be higher quality transmission and the ability to connect devices of differing baud rates.

An interesting extension of this service will be the provision of microcomputer software to libraries to assist their internal administration of tasks associated with interlending, such as keeping track of borrowers, recalls, etc. The Lending Division has awarded a grant to Leicester Polytechnic to find a suitable microcomputer database package that could form the core of such a system. A further potential application would be the use of the microcomputer to search remote databases, retrieve references, store them locally while the user's own stock is checked and then transmit requests for items not available locally to the Lending Division via ARTTel.

One alternative to mail on the periphery of automated document requesting, but which is nonetheless relevant, is the Division's Urgent Action Service. This is being offered initially in the UK, whereby users can telephone the Division and receive personal attention and an immediate response as to the availability of the item required. Unlike the other methods of automated document requesting the Lending Division does impose an extra charge in this case to cover the personal service. The service, which is still very new, has proved very popular for that occasional request that is very urgent and for which the user is prepared to pay extra. It is hoped to offer this service abroad when sufficient experience has been gained with the pilot scheme in the UK. Facsimile transmission of the document is also intended to be offered as an option.

Possible lines of development for the Lending Division's ART service include in the medium term receipt of requests via Prestel, the UK public viewdata system, and over private viewdata networks, though it should be noted that investigations into the provision of such links are still at a very early stage. The Division will also be hoping to draw on the BL Science Reference Library's experience with its recently announced electronic mail service, whereby it will accept patent requests via British Telecom Gold.

3. FACSIMILE TRANSMISSION

Facsimile transmission is a technology that has been used to good effect by the Japanese and the newspaper industry for some considerable time now. The British Library, too, has several years of experience using Group 2 machines for transmitting documents from the Lending Division at Boston Spa in Yorkshire to readers in the main reading room of the Science Reference Library in London. Requests are sent either by telephone or by fax. By and large transmission of the documents has to be slow to achieve acceptable quality, and dedicated lines are eminently preferable to dial-up connection which is expensive and prone to quality problems.

The increasing availability of the more advanced Group 3 machines and an expression of interest by Chalmers University of Technology, the DOCLINE agent for a group of Swedish libraries, prompted the setting up this year of a three month experiment to explore the possibility of facsimile transmission as an alternative to mail for the despatch of documents. The results show that it is still expensive, at approximately £1 per page to transmit to Sweden, even over packet switched networks. It is also labour intensive in that photocopies have to be produced first in order to feed the single sheet scanner, and up to 1 in 4 pages need to be retransmitted. However, quality is acceptable, and it is thought that, as with the Urgent Action Service, users will be prepared to pay for the occasional urgent item. Planning for this service is proceeding currently.

4. ELECTRONIC DOCUMENT DELIVERY

Before examining the factors that may affect the growth of electronic document delivery and reviewing existing services and plans for new ones, it is advisable to understand what is meant by the term. Because it covers a multitude of variations, any attempt at a standard definition would have to be so all encompassing as to be meaningless. It is best therefore to try to visualize the components of a system by example. Figure 4 represents in greatly simplified form an idealized system which makes use of several of the newer technologies heralded as the most likely components of electronic document delivery services of the future.

Thus there is a large store of documents held on a jukebox of digital optical recording (DOR) discs. There are other technologies which might be used instead, such as videomicrographics or conventional magnetic discs that are used for existing full text retrieval systems, but DOR is generally thought to offer the most potential for cost effective, very high density storage of documents, especially those that comprise both text and graphics.

Requests could be received by the document supply centre in any of the ways described earlier. The desired item would be located on the DOR store by indexes to the document collection mounted on a computer. These indexes would enable the supplier (or the user if he is allowed access) to translate bibliographic citations (or article numbers from information retrieval systems) into an address in the store.

Once retrieved the document would be transmitted by satellite to the requester's ground station. Satellites will offer the high speed, wide bandwith telecommunications necessary for the transmission of graphics or facsimile images of text which require large volumes of bits to represent them. The integrated services digital networks (ISDNs) being planned by several of the world's PTTs could also be used for the transmission of documents. Moving down the scale, existing packet switched or telephone networks are being used currently for retrieval from full text databases mounted on magnetic disc stores, but here speed of transmission is a limiting factor. At the low technology end of the distribution spectrum the ADONIS project (of which more later) in its initial phase would have relied upon a network of distribution centres, each with its set of DOR discs, which would print documents on demand for despatch to requesters by mail or transport scheme. In this case much of the speed advantage would have been lost. A further variant would be the sale of DOR discs to user libraries, but this then becomes more an alternative form of publishing than electronic document delivery.

The last main component is the user's ground station and means of obtaining hard copy. Here laser printing could offer fast, high definition printing. The cost of laser printers is falling rapidly. An optional facility might be the ability to view a document in part on a VDU to assess its relevance before requesting the full text from the supplier.

An element in the electronic document delivery chain that deserves equal attention is how the documents are reduced to electronic form in the first place. A longer term possibility is that output from publishers' computer typesetting processes can be loaded directly onto DOR discs. This is attractive in that the text can be recorded in character encoded form which is much more compact than a facsimile image. Graphics would have to be stored in facsimile form alongside the text. However, the variety, complexity and idiosynchracies of computer typesetting system may pose a serious obstacle to this goal.

Of more immediate application is the facsimile imaging of both text and graphics. Print on paper is a form of publishing that is likely to continue for some considerable time to come, if not indefinitely. This will form the source document from which laser or charge coupled device (CCD) scanners will produce the digitized image. The disadvantage of most present day scanners is that they cannot readily take bound documents. Journal issues or reports have therefore to be cut up or photocopied before scanning.

A scanner being developed for the British Library will overcome this. The Library needed a device to produce digitized images for:

- conservation on DOR discs of items prone to decay (including the image enhancement and extraction of watermarks)
- provision of copies to readers
- electronic document delivery

Image capture had to be achieved rapidly, at high resolution and without damage to bindings. The solution was a scanner that holds the book open 80° and has a head that under fine motor control lowers onto the book and then scans both open pages using a CCD mechanism. Resolution is 300 lines per inch, retaining detail down to 6 point type. The scanner is currently being prepared for production, a prototype having been successfully demonstrated.

A further option on the electronic document delivery model being considered is whether digitization of hard copy source documents should take place on receipt by the document delivery centre, or as requests are received. Which is chosen depends largely upon the spread of requests over the collection, the demand for loan of the original journal, the costs of scanning and, to a lesser extent, the costs of storage. It is probable that only core lists of documents that account for a significant proportion of demand will be digitized on receipt.

Having outlined by example what constitutes electronic document delivery it is now possible to review the factors that will affect its growth.

5. FACTORS AFFECTING GROWTH

It is the intention to concentrate upon the user viewpoint when examining the factors affecting the potential growth of electronic document delivery systems, because as the consumer he is the ultimate arbiter of what will and will not succeed. A checklist of factors that will determine his use of electronic document delivery systems might be:

Convenience/success
Speed
Cost
Quality
Compatibility of systems

A survey of user needs(5) conducted primarily in the UK showed that the most popular features of such services would be the ability to:

- obtain a comprehensive range of documents from a single source
- view the document directly on a terminal
- order via a terminal
- check availability and price of documents

The first feature suggests that electronic document delivery services should ideally either be associated with existing conventional document supply services or at least be able to offer a comprehensive service for a well-defined subject area. This underlines the convenience factor in the checklist. Clearly a high success rate for requests is an unspoken but essential requirement.

It is interesting to note with regard to speed that, while the survey showed that 67% of librarians mentioned delay in delivery as a cause of difficulty with existing interlending services, end users were on the whole satisfied with the timeliness of documentation services they received. However, a high proportion (82%) did think it would be worth paying extra for the rapid delivery of an important document. This suggests that electronic document delivery must be competitive with conventional interlibrary supply in terms of cost, quality and convenience of use before it really establishes itself. Speed alone is not enough, other than for a small number of urgent requests.

Compatibility of systems is almost a prerequisite. Unless the single source requirement is met, the user will inevitably want to access a variety of systems ideally using one set of equipment. This either means sophisticated multi-access terminals or a degree of standardization between document delivery systems. This could be a problem in that the way of transmitting text may be as facsimile image or encoded characters, and, especially if input from computer typesetting systems is used, the character sets and encoding thereof may also vary.

Other factors besides those seen by the user will also affect the growth of electronic document delivery systems. One set of issues is copyright and the whole delicate balance between publishing, document supply and library acquisitions. Commercial and technical factors are tending to blur the distinction between publishing and interlending, especially with the concept of on-demand publishing and the desire of publishers to

receive revenue from the copying of their documents. However, this topic could be the subject of a complete paper by itself. In recent articles Line(6) and Russon(7) explore this spider's web of interactions.

6. CURRENT INITIATIVES

One of the main purposes of this paper is to chart the progress made towards electronic document delivery systems. The most concrete progress has been made in the area of full text retrieval from conventional database systems. Besides the well-known Mead Data Central full text legal files (LEXIS) and news files (NEXIS), recent examples are Elsevier's IRCS Medical Science journal(8) mounted on Bibliographic Retrieval Services (BRS) and the recently announced mounting on BRS of a quarter of a million pages from 18 titles published by the American Chemical Society (ACS)(9). Coverage of the ACS file extends back to 1973, and access costs between $70 and $85 per hour plus communications charges. The major drawback of using conventional database services is that they are essentially limited to text only. Pergamon have found a way round this with the VIDEO PATSEARCH service(10). Here details of patents are available on-line from the Pergamon Infoline database system, and graphics are distributed on videodiscs for use on specially developed terminals.

There are in addition a few electronic mail applications within automated offices and the forthcoming facsimile transmission service of the British Library Lending Division. However, as yet there are no operational schemes that take full advantage of the technologies exemplified in the schematic representation of electronic document delivery used in this paper. Nevertheless there has been a tremendous amount of planning activity.

Unfortunately one of the most well publicized schemes, ADONIS, is currently shelved. The consortium of Scientific, Technical and Medical (STM) publishers that are involved in the project found the economics to be unfavourable at the present time, but, of course, this situation could change rapidly. The ADONIS project would entail the consortium, probably acting for other publishers as well, recording their STM journals on DOR discs by scanning guillotined pages in facsimile mode. These discs would be distributed under licence to document delivery centres, such as the British Library Lending Division in the UK. The centres would then print articles by LASER printer in response to requests received from user libraries. Initially the copies, which would contain both text and half tone graphics, would be transmitted by mail or van scheme, but the use of satellite transmission was envisaged for a later stage.

A project to which there is a much firmer commitment is the UK Government sponsored Project Hermes(11,12). This is due to begin operation at the beginning of 1984 and will be based on British Telecom's Teletex service, which will also come into operation at that time. A number of publishers, information providers and other organizations such as the British Library are currently discussing participation in the project. The initial phase, which will last about a year, will provide electronic mailing of documents between one site and another, automatic document delivery (for the regular delivery of electronic newsletters, contents lists of journals and books etc) and ordering and delivery facilities for specified documents. Equipment for the first phase can consist of word processors, Teletex teleprinters or electronic typewriters with storage and one line display facilities. "Black box" adaptors will be available to interface equipment to the Teletex network. Documents will be character encoded. Projected transmission costs are 5p or less per page with considerably cheaper rates for overnight transmission.

Should this first phase be successful, later phases of the project will provide connection to information retrieval database systems and extension to cover facsimile transmission from large stores of data possibly on DOR discs. The latter extension will depend upon the enhancement of the CCITT convention to allow embedded graphic material to be transmitted and printed using facsimile techniques. The limitations of Teletex with regard to transmitting the large volumes of bits required to represent graphical information (at least an order of magnitude greater than for encoded characters) will mean that the quality, speed and cost of transmission will have to be closely monitored.

The problems of integrating text and graphics are the subject of Project Universe(13). This is a cooperative research programme involving a number of industrial and academic organizations, British Telecom and the UK Government. In essence the project involves interfacing a number of local area networks (based on the Cambridge Ring) via satellite (the Orbital Test Satellite). At present these local area networks support modified BBC microcomputers with high resolution graphics facilities and colour printers, but in the future it is intended to connect a variety of equipment including facsimile and teletex devices. The team is in fact working towards multimedia documents which may include voice alongside text and graphics.

The Commission of the European Communities (CEC) has a considerable interest in electronic document delivery, which can be said to have begun with the ARTEMIS report(14). Earlier this year at an international electronic publishing conference(15), jointly organized by the CEC and the International Electronic Publishing Research Centre, the results of studies into some of the problem areas were presented and discussed. These studies concerned user needs, the definition and coding of standard character sets, the use of computer typesetting input as the source of digitized material, the distribution of electronic documents and the development of user terminals to receive them. In addition the CEC has invited proposals for projects in electronic publishing and document delivery. A number of proposals have now been selected to be pursued to the next stage. CEC involvement is also anticipated in the APOLLO Project(16), in which the European Space Agency will be a central participant. The precise area of application of

the project is still under discussion, but it will centre around use of the European Communications Satellite for the transmission of documents.

7. CONCLUSION

Clearly there is a great deal of activity which should come to fruition over the next few years. The list of initiatives covered is not exhaustive; indeed there are a variety of projects in electronic publishing such as the British Library sponsored BLEND-LINC project(17) which may impact on document delivery systems in the future. However, it is hoped that the extent and pace of progress has been demonstrated. It will be an area of vigorous development, keeping track of which will be both difficult and fascinating.

What is essential is that the users' needs are borne very much in mind. Copyright considerations and too great a preoccupation with commercial advantage should not be allowed to distort or fragment document delivery systems to the detriment of the efficient retrieval of information by the user. An effective information chain is crucial not only to high technology research, such as in the defence and aerospace fields, but to the economic well-being of the community in general.

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FIGURE 1:

Alternative methods of requesting

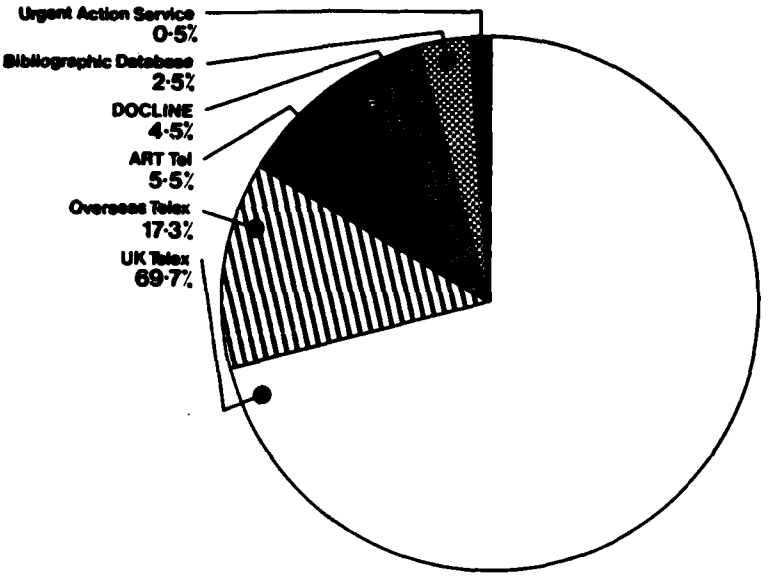


FIGURE 2:

DATABASE SERVICES

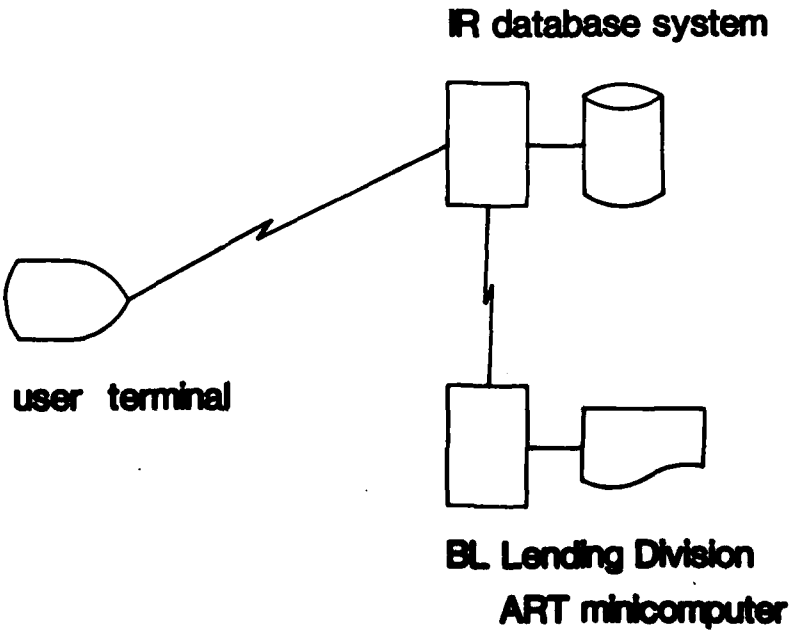


FIGURE 3:

ARTTEL

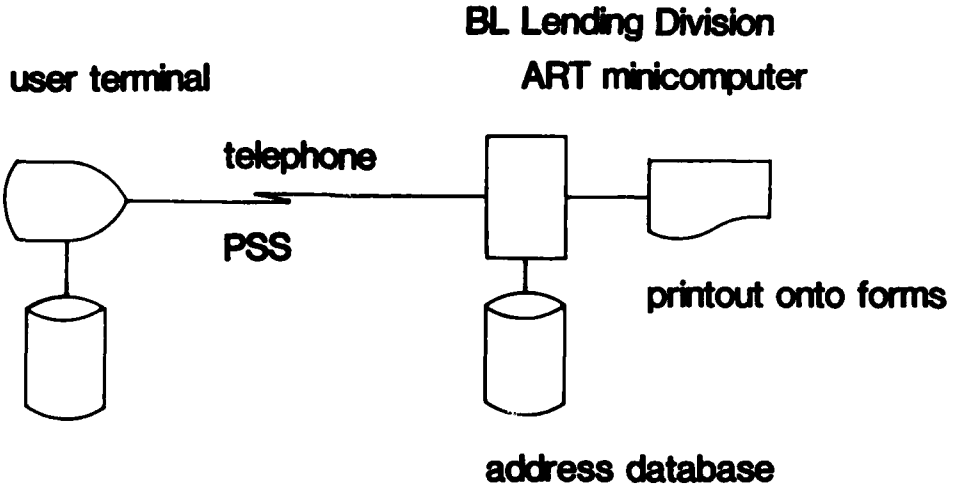
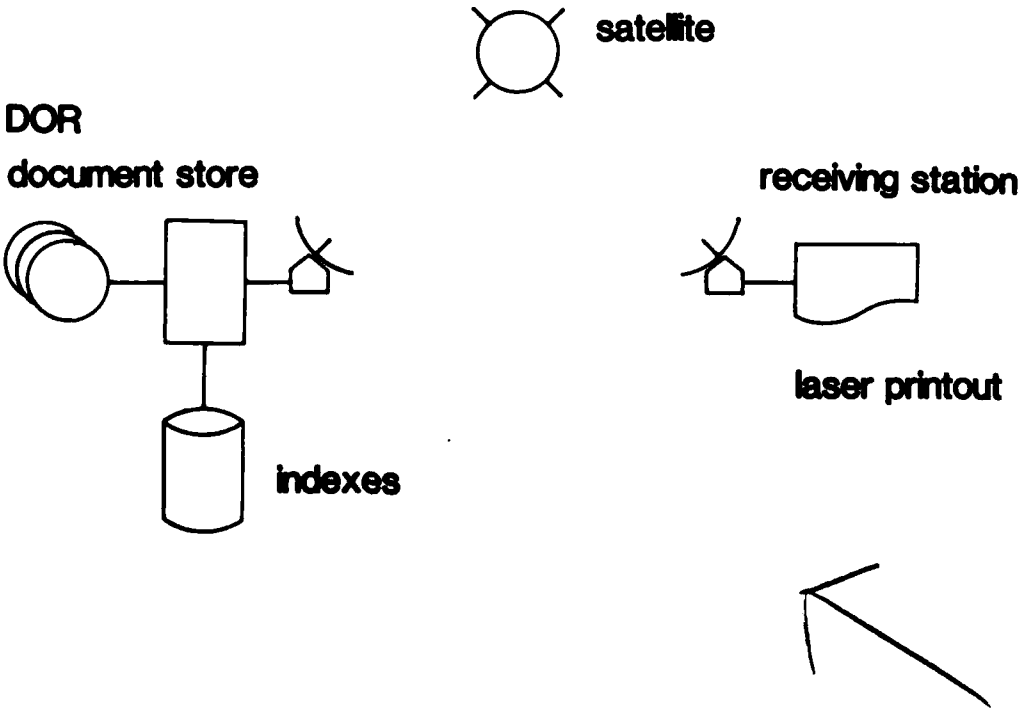


FIGURE 4:

ELECTRONIC DOCUMENT DELIVERY



TECHNICAL EVALUATION REPORT

on the Symposium on "The Application of New Technologies to Improve the Delivery of Aerospace and Defence Information" held in Ottawa, Ontario, Canada, on 14-15 September, 1983.

Session I: In this Session a number of recent developments in computer-systems, their problems and difficulties were discussed.

The first paper, "Open Systems Interconnection", drew attention to the use of common computer communication for the exchange of information-data among various users, a rather complex subject to be solved.

The second speaker described the "iNet Gateway Trial", a specific example of open system interconnection, in which the information-user is served by a single point of access into a great variety of computer systems.

"Sharing Command Languages and Software" was the theme of the third speaker. He finished his very interesting and clear presentation with the "Questel plus compromise", a possible answer to the need for portable retrieval software for use in a network environment with different computers.

This Session closed with the presentation of "Use of Distributed Information Systems by the Office of the Secretary of Defense, USA". The speaker pointed out a great number of common and unique administrative applications and concluded his presentation with his view of the future.

The second speaker, Mr Wolters, a Canadian, was very much appreciated by the audience; the discussion after his presentation was the highlight of this Session. In general, the discussions could have been better.

A rating for Session I would be 'very good' for the general level of papers, and the effectiveness of speakers presenting their papers. Paper 1 was a bit too detailed for the audience, but essential to explain the problem.

Session II: This Session, devoted to "Data Base Developments" was a rather technical one, with three presentations devoted to Scientific Numeric Data Bases, Graphic and Visual presentation of Data and Standardisation of Bibliographic Data.

The first paper, dealing with a modern problem, seems to have been the most attractive and raised several questions. The second, dealing with the simulation of a multimedia-system, was perhaps difficult, and the third paper, dealing with a classical topic, occasioned more modest audience participation.

The general feeling is that this Session was an interesting one, of reasonable interest to the audience.

Session III: Mr Hart's paper on management techniques was interesting, well delivered, and contained management principles and policy considerations which were pertinent to the audience. It was not too detailed, and it was because of this that it elicited excellent audience participation. It seems that people are interested in learning new ways and means to get the job done.

Mr Coppock's paper on contract managment was interesting and well delivered. It presented the basics of a good management tool, and the detail it contained was sufficient to describe the technique. Audience participation was excellent.

Dr Palme's paper on computer conferencing was pertinent to the Session, but was perhaps too detailed for some of the audience. His accent presented some difficulty in understanding and, perhaps in consequence, audience participation was poor.

Mr Ede's paper on document request and delivery systems was pertinent to the Session but was too detailed, and went deeply into library functions. Mr Ede's delivery of the paper was very good, and if his paper had been more general, addressing techniques only, the audience participation would perhaps have been better than it was.

All the papers presented in Session III were pertinent to the Session, and to the overall theme of the Symposium. There was a good mix of persons presenting papers: three nations were represented.

Overall rating for Session III would be 'very good to excellent' for coverage of the subject, 'good' for audience participation, 'very good' for delivery of papers.

The Forum Discussion: Questions and audience interest can be grouped in the following categories:

- The progress of new technology and its impact on the scientific and technical information community
- The cost and value of information
- The difficulty in maintaining a comprehensive technical report acquisition service.

The discussion was characterized by a high level of audience involvement. Equally important, the speakers, all well qualified, were available to participate in the discussions, and assisted in chanelling the discussion in a most productive fashion.

Based on the audience interest in this Forum session it is recommended that they continue to be a part of TIP Specialists' Meetings. The transcription of the Forum Discussion from tape to text copy will provide the necessary details of this very valuable part of the Ottawa Meeting.

Participants: There were 113 persons present at this Symposium, comprising 21 Panel Members, 10 Speakers, 25 non-Canadian and 57 Canadian participants. The attendance was about 75% of the enrolment list. Curious was the small number of European participants, 4 in total, Speakers and Panel Members not included.

The majority of the audience were librarians, technical information specialists and managers. There was a small number of scientists present.

Arrangements: The physical arrangements were extremely good and the meeting was effectively organized. Sufficient time and space was made available to allow attendees to have productive discussions with one another and with the Speakers.

The Session Chairmen were very effective in managing the flow of presentations, and the subsequent discussions.

Generally, most Speakers did a good job in presenting their topics; the effective use of slides and the overhead projector helped to make the talks more interesting and easy to follow.

Language was no problem and the interpretation arrangements were quite satisfactory.

Consensus of Opinion: The overall rating for the entire meeting would be 'very good', coverage of the subject matter and delivery of papers included. There was a good mix of persons presenting papers (seven nations were represented). Audience participation was a little disappointing. This conclusion is made with the kindly cooperation of the Session Chairmen, the Chair-persons of the Forum Discussion and in agreement with the 31 completed questionnaires and forms submitted by members of the audience.

Recommendations: Distribution of the Preprints in advance of the Symposium would be helpful to give participants a chance to read the papers and prepare any questions they may wish to address to the speakers.

The meeting was not sufficiently well focussed on specific topics and, in consequence, tended to 'ramble' a little. The information transfer to the audience was therefore less than optimal. Consideration should be given to a clearer definition of topics (such as hardware and software; security; management; etc.,) in structuring future meetings.

Continuation of the inclusion of a Forum Discussion session at future TIP meetings is recommended.

Ir E Grutzmacher
1983 TIP Meeting Director

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14. Abstract

These Proceedings concern an AGARD Technical Information Panel Specialists' Meeting held in Ottawa, Canada, in September 1983. The eleven papers presented were grouped in three sessions entitled: Systems Development, Data Base Developments, and Management Developments, ~~respectively.~~ There follows a Technical Evaluation Report, written by the Meeting Director, ~~which~~ assesses the impact and usefulness of the Meeting.

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